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ABSTRACT

An interpretive report of the conference "Creative Partnerships in Technology: An Open Forum," held in Atlanta, Georgia, fall 1983, is presented. The first section, "Computers and Learning," discusses the fact that the instructional capacity of the computer makes it possible to transcend the limits of the current educational system. The need to rethink instructional practices is outlined and indications are made that the basic motivation for education has changed, e.g., with increasing computer use the role of memorization in learning may be on the way out. Section 2, "Beyond the Computer--Skills for Tomorrow," redefines skills needed in a technological age and suggests the following trends: (1) the growing importance of public and private partnerships supporting public schools, (2) an increased emphasis on lifelong learning, (3) greater cooperation within the educational community, and (4) the need to bring about legislation and public support for major philosophical change. In section 3, "Computer Literacy," the definition and evaluation of computer literacy are discussed. The fourth section, "Realizing the Potential--Making Technology Work in the Schools," discusses the assessment of teacher competencies, the evaluation of software, and the use of networking. Case studies of California's and West Virginia's educational computer programs are provided in section 5, "The Process of Change--Two Approaches." Section 6, "Next Steps--Forming a Regional Agenda," discusses planned partnerships for positive change. The keynote address, "A Nation's Schools in Transition," presented by LeRoy Hay, the 1983 National Teacher of the Year, is included along with five appendixes. (MD)

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SCHOOLING & TECHNOLOGY

Volume 3

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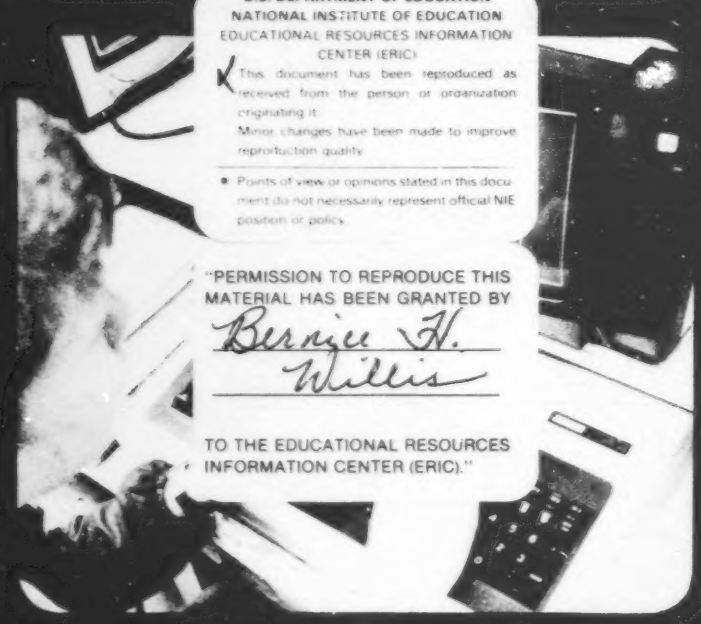

Planning for the Future: A Collaborative Model

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An Interpretive Report
on
"Creative Partnerships
in Technology –
An Open Forum"

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SCHOOLING & TECHNOLOGY
Volume 3

Planning for the Future:
A Collaborative Model

May 1984

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for Educational Improvement

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FOREWORD

A friend once described his passion for Mozart as "a wondrous sense of inevitability. When you listen to a Mozart violin concerto, for example, you come to realize, note for note, that it could not possibly have been written any other way."

We at the Southeastern Regional Council are beginning to feel a similar "sense of inevitability" about the role of technology in education. In a more hackneyed phrase, it is an idea whose time has arrived. We also have realized for some time that technology represents both complex challenges and immense potential for public education, and we derive satisfaction from our role as *provocateur* in raising the questions and issues related to the topic, for both national and regional audiences.

Such activity for the Council began in earnest with publication last year of *Schooling & Technology — Volume 1, State-level Policy Initiatives, and Volume 2, The New Equation: Student, Teacher, Unlimited Information.* These were efforts, based on information shared with us by education agencies across the country, to understand the nature and complexity of policies which were shaping the technology issue (Volume 1), and to project the likely implications for public education as the computer finds its way into public school classrooms across the land (Volume 2). We're pleased to report that these publications were well-received in the national education press, by state education agencies across the country, and — most importantly — by our own constituency here in the Southeast Region.

It soon became very clear that many others shared our enthusiasm, questions, and concerns in considering the full implications of the microchip for the whole business of teaching children to learn. This shared interest brought us to Atlanta last October for two days of brisk fall weather and lively discussion. More important, the meeting took us a giant step forward in setting a regional agenda for the southeastern states to move public education into what we now call the Information Age.

It was an excellent conference. Called "Creative Partnerships in Technology: An Open Forum," it brought together some 100 education leaders in the region — many with great expertise in this exciting new field. Four objectives were set for the meeting:

- To share ideas and activities among the member states on criteria and processes of software selection, techniques of software and hardware review and group purchasing, and other emerging strategies as SEAs and LEAs deal with the issue of technology in education.

- To identify activities that could be initiated as next steps in the member states and in the region to address long-range goals.
- To help SEAs increase their leadership ability in dealing with technology in education.
- To promote cooperation and collaboration among the member states and among constituencies within states.

As it turned out, our conference discussions went far beyond these topics, embracing such subjects as the computer revolution, the instructional potential of computer technology, experimentation in the use of computer and other electronic technologies, and the role of partnerships – with business, industry, and higher education – in achieving goals in educational technology.

To address the objectives of the conference, participants engaged in a variety of program activities, including presentations by representatives of business and private research initiatives in educational technology. Two presentations described activities in California and West Virginia to introduce technology statewide; and educators with differing perspectives (e.g., teachers' unions, higher education) offered reactions to the West Virginia presentation.

From this synergism emerges *Schooling & Technology (Volume 3), Planning for the Future: A Collaborative Model.* It is not, in a traditional sense, a "conference proceedings," but rather an interpretive report of the ideas and experiences shared by many people in two busy, stimulating days.

It is aptly titled, for collaboration was a key theme as presenters and educators from across the region expressed again and again the need to share, to plan, and to move forward together. This volume is presented in that spirit. It offers first discussion of the five major issues which emerged from the conferees' conversations:

1. *Computers and Learning* – what is happening now in computer-assisted and computer-managed instruction, what is imminent, what is likely to occur by the end of the decade.

2. *Beyond Computers – Skills for Tomorrow* – There are new basic skills required in the Information Age and therefore new student competencies – some well-understood, others still to be defined.

3. *Computer Literacy* – Whatever it is, it's important, it varies from place to place, and it's relevant for teachers as well as students.

4. *Realizing the Potential: Making Technology Work in the Schools* – Success in embracing the new technology means staff training, well-designed courseware, and efficient delivery systems.

5. *The Process of Change – Two Approaches* – case studies of methods, policies, laws, and attitudes concerning schooling and technology in California and West Virginia.

The publication concludes with three important sections:

- *Next Steps – An Agenda for the Region,* Solicited from conferees near the conference's end, and fleshed out by the Council's new Technology Advisory Committee after thoughtful consideration of a verbatim transcript of the two-day meeting.
- An edited text of the remarks offered by Dr. LeRoy Hay, 1983 National Teacher of the Year.
- Appendices, including a listing of resource persons, a bibliography, and other pertinent material.

Permit me to offer special thanks to staff of the Florida, Georgia, Louisiana, and North Carolina State Departments of Education who prepared "white papers" to support the vitally important small group discussions from which so much of the following material emerged.

It is our great hope that in sharing many of the ideas, the information, and the good, hard questions raised at this conference, we will also convey some of the excitement of the meeting and the commitment felt on behalf of the schools and students of the region. Finally, we hope also to share the optimism and determination of the conferees to make the future of the schools in the computer age a bright and powerful one.

Charles J. Law, Jr.
Executive Director

Conference Objectives

The October, 1983 conference in Atlanta, Ga. — "Creative Partnerships in Technology — An Open Forum" — had a number of specific and important objectives:

- To provide participants with a broad, informed, and insightful presentation of the critical issues confronting public education in the Information Age, short-term and long-term. This keynote presentation was offered by *Dr. LeRoy Hay,* National Teacher of the Year.
- To offer a practical look at the technology at work today, assessing its strengths and limitations. The presenter was *Dr. Dustin Heuston,* Chairman, World Institute for Computer-Assisted Teaching Systems.
- To promote further understanding of education as a marketplace for the new technology from the point of view of business and industry. *Dr. Harvey Long,* of IBM, and *Dr. Barry Berman,* Monroe Systems for Business, were presenters.
- To explore, in depth, some of the options which exist for states as they develop policies, laws, and regulations concerning schooling and technology. West Virginia's comprehensive response to a legal mandate was described by *Nicholas Hobar* of the state's Department of Education. California's far different approach was described by *Sharon Sprowls,* a member of the General Assembly's legislative staff.
- To provide conferees with many opportunities to share their own experiences and thinking on the topic in a structured way. Staff from four southeastern states prepared discussion papers to facilitate these sharing sessions.

Acknowledgements

A Forum Planning Committee, with representatives from seven states and the Southeastern Regional Council, played the pivotal role in designing the conference, engaging presenters, and providing the energy, enthusiasm, and expertise which assured success. Its members were:

Margaret Bingham, *Computer Coordinator, Division of Media & Technology, North Carolina Department of Public Instruction*

David Brittain, *Administrator, Education Technology, Florida Department of Education*

Elsie Brumback, *Assistant Superintendent for Media & Technology, North Carolina Department of Public Instruction*

Jess Elliott, *Director of Research, Division of Planning, Research, and Evaluation, Georgia Department of Education*

Alfonso J. Evans, *Educational Supervisor, Office of Planning, South Carolina Department of Education*

Nicholas Hobar, *Assistant Bureau Chief, Division of General and Special Educational Development, West Virginia Department of Education*

Shirley McCandless, *Administrative Officer, Management Information Systems, Louisiana Department of Education*

Amy McMurtrey, *Consultant, Teacher Education and Staff Development, Georgia Department of Education*

Stephen M. Preston, *Director, Division of Planning, Research, and Evaluation, Georgia Department of Education*

Bernice H. Willis, *Deputy Director, Southeastern Regional Council for Educational Improvement*

Presenters

LeRoy Hay, *1983 National Teacher of the Year, is chairman of the English Department in a Connecticut high school. Witty, youthful, with far ranging interests, he has been a teacher for 18 years. An active futurist (he earned his doctorate in futurism), Dr. Hay is concerned that students learn to deal with the constant of rapid change. He serves on the Congressional Task Force on Merit Pay, the Presidential Scholars Program, and the Editorial Advisory Board for Education Digest.*

Dustin H. Heuston *offered conferees the unique perspectives of one who is not only an educator but involved in both non-profit and for-profit business enterprises. After a long career as student, teacher and school administrator, he founded the World Institute for Computer-Assisted Teaching Systems (WICAT) in 1977. It includes a variety of experimental activities – such as software development and a private school operated by the Institute in Utah. Before founding WICAT, Dr. Heuston was headmaster of the Spence School in New York City, Department Chairman at Pine Manor Junior College, and on the faculties of Brigham Young University and Vassar College.*

Harvey Long *is an education applications consultant for IBM, with a special interest in exploring the educational capacities and the educational market for the IBM personal computer. His PhD is in mathematics.*

Barry Berman *is district manager for microcomputers for Monroe, based in Atlanta. Earlier he was manager for academic services, North Carolina Educational Computing Service. His advanced education is in physics.*

Nicholas Hobar, *deeply involved in the development of the West Virginia state plan for the use of technology in the public schools, is Assistant Bureau Chief, Division of General and Special Educational Development, West Virginia State Department of Education.*

Sharon Sprowls *is a specialist in education, budget, tax, and family law issues and legislation. As a consultant to California State Assemblyman Richard Katz, she helped to draft the state's legislation on education technology. She is currently serving as Associate Consultant to the Policy Research Management Committee, California State Assembly.*

Reactors *to the presentation by Nicholas Hobar were* **Donald Dearborn**, *Assistant Superintendent, Alexandria, Va., public schools;* **Willis Furtwengler**, *Office of Educational Services, Peabody College at Vanderbilt; and* **Carolyn Lee**, *President, Georgia Association of Educators.*

Acknowledgements

• *Special acknowledgement is due to SEA staff members from Georgia, Florida, North Carolina and Louisiana for their efforts and skill in preparing discussion materials on a number of topics for the conferees, as follows:*

Computer Literacy – **Shirley McCandless**, *Louisiana Department of Education; Software/Networking –* **Elsie Brumback, Margaret Bingham**, *and staff of the Division of Media and Technology, North Carolina Department of Public Instruction; Student Competencies –* **Jess Elliott**, *Georgia Department of Education; Teacher Competencies –* **David Brittain, C. Pristen Bird**, *and staff of the Educational Technology Section, Florida Department of Education.*

1 The Issue:

Computers and Learning

Tantalizing for some, mysterious, even frightening for others, computers are accepted by most in the educational community as representative of a new era in schooling. Regardless of perspective, computers have arrived to stay on the school scene, and their presence raises two sets of issues.

First are philosophical matters: What is the computer's potential (and appropriate) role in the educational process? What are the hopes and fears associated with computerized education?

Second are practical concerns: How can we ensure the effectiveness of computer use? Test and evaluate computerized instruction? Introduce educational technology into school programs?

Discussion

DEVELOPING THE POTENTIAL OF AN AMAZING TOOL

Clearly, the expectations of computers as educational tools are enormous. As far back as 1970, Dustin Heuston (see Notes on Speakers, page 5), told the conferees, he was intrigued by the notion "that memory would essentially be given away by 1990. By that date – or sooner – you will have quite a few million transistors and a full, very powerful computer on a chip the size of your fingernail. I realized even then that for a few dollars we'll have unlimited power in memory available to everyone – and I began to understand that the history of education was going to change."

Time – how it is used and how it is limited – is a key consideration in the educational process, Heuston pointed out. "For every hour you spend in school as a student, you can have 10 seconds of personal interactive instruction. Extrapolated to a day, it's one minute. If you extrapolate that to a year, you would have half a day of personal interactive instruction – trials with feedback. That's been measured on numerous occasions." The end result, he said, is that students from kindergarten throuth high school have about six and a half days of personal instruction – "and the time limits of the system are fundamental."

The good news is that computers may change such constraints. "A microprocessor harnesses the speed of light," said Heuston. "When we start working with roughly a million instructions a second – programmed to see how the student is doing and to interact with the student – we'll be able to do all sorts of things" which at present are impractical or impossible.

TRANSCENDING PRESENT LIMITS

Thus, Heuston said, the computer makes it possible to transcend the fundamental limits of the current educational system. Computers can provide limitless hours of one-on-one instruction, patient tutoring, and "trials with feedback." They can adapt equally well to a Spanish-speaking child, a deaf child, a gifted child. They can move forward quickly when the student is ready and as easily slow down when the child reaches a problem area. At least potentially, computers are equally effective tools for rote drills or creative writing and design. In short, like humans, computers have the capacity for infinite adaptability and responsiveness to individual children. But unlike humans,

Dustin Heuston

Heuston said, computers are *not* limited by the present time constraints of classroom teaching.

Equally important is the computer's ability to transcend the time limitations of managing schools and instruction. Computers make possible much more efficient record-keeping systems, student monitoring and assessment systems, and educational planning.

The most interesting discovery, Heuston said, has been the computer's capacity to aid the management of the instructional process. "We've been absolutely staggered by realizing that the computer has the capability to act as if it were 10 of the top psychologists working with one student. It can give testing like you cannot dream of to turn up learning disabilities, cognitive black holes – all kinds of problems. At the fall of every year, you'll have a fast scan of your children going through these test programs. You will immediately pick up dyslexia and learning disabilities, just sort of as a throwaway. The computer will also test where the children are in their current skills. Then, most exciting of all, it will get the kids to show what they are remarkably good at.

"The computer takes 75 years of testing knowledge and puts it all together – and does it so fast! It doesn't make you go sequentially through every question on the test. It starts here, jumps there, hones right in until it has you. Then it goes on to something else. It is going to be absolutely spectacular to see the kind of information that will be afforded a teacher, a student, and parents about career implications."

Those two aspects of computer use in the schools – referred to generally as "computer assisted instruction (CAI)" and "computer managed instruction (CMI)" – reveal some of the enormous potential computers have to alter the schooling process. Perhaps the greatest potential of computers, Heuston suggested, is the almost limitless access they offer to information and instruction. "You've seen the tip of the iceberg. Won't it be wonderful when the child in the smallest county in the most distant area or in the most confused urban setting can have the equivalent of the finest school in the world on that terminal, and no one can get between that child and that curriculum? We have great moments coming in the history of education!"

Along with that excitement, Heuston and other presenters shared a message of caution with the conferees. Computerized learning is indeed in an embryonic stage, and there is consequently great need for careful deliberation and planning as the ubiquitous computer comes to school, they said.

LeRoy Hay

Consider some of the implications beyond CAI and CMI, Leroy Hay urged the conferees. For one thing, the shrinking size and cost of computers of all kinds makes them increasingly accessible to everyone – in and out of school. "In this decade," Hay pointed out, "we're beginning to see computerized wristwatches. The kids are going to come into your classrooms not only with the wristwatch that tells time in several time zones and plays music and has a Star Wars game and a calculator, but is also a computer."

A COMPUTERIZED WORLD

Computing machines of all kinds are already commonplace and becoming more so – in all aspects of our lives, Hay said. The world outside the classroom is becoming computerized. [See *Issue 2: Beyond the Computer – Skills for Tomorrow,* for some of the broad implications of that computerization process.] Therefore, learning opportunities – and learning motivation – aren't exclusive to schools. Home computer companies market a wide range of educational programs; computers are an increasingly integral part of most work and play activity. The rapidly changing world that is the product of the computer age is altering the role of schools and the fundamental motivation of students.

Said Hay, "It is my perception that students are choosing not to learn today primarily in the public schools," but from a myriad of sources outside of the school.

"Part of the problem is that we still try to sell education the way it was sold to us – as an exercise in delayed gratification. We were told, 'You've got to learn this today, because you're going to need it tomorrow, and that diploma is going to promise you a good life.' We can't promise that anymore," Hay said. "We can't tell those kids that a diploma is a guarantee. We have to realize that the basic motivation of education no longer can be a promise for tomorrow."

Computers, Hay suggested, are at the root of the changing role, and perhaps the changing value, of schooling. He also thinks they may be the source of a new form of motivation to learn and the model for 21st Century schooling. Memorization may be declining in importance as an instructional goal, Hay suggested, and "information processing" may be on its way in. "If we are turning out kids today who are not capable of knowing how to ask the right questions and to access information and then to know what to do with it once they get it," Hay said, "we are doing a disservice."

And the motivation for youngsters to reach for these new educational goals, he suggested, may

simply be to gain access to the exciting, fast-paced, multi-media world they live in – through its primary medium, the computer.

Along with the growing accessibility and sophistication of computing machines is the tremendous growth of information. John Naisbitt, author of *Megatrends,* and others project that the world's information will soon be doubling every 20 months!

QUESTIONING BASIC ROLES

The implications? For Hay, the age of computers means "we have to begin to question whether or not we are in the answer business. We're going to have to question something as important as this: What is the role of memorization in the teaching and learning process?" In the first place, Hay pointed out, there is already too much information for any one person to remember, and that information base keeps doubling and redoubling. Secondly, the increasingly efficient computers can retrieve and process data at speeds of 10 billion operations per second! The impact on a schooling system that has long emphasized memorization as an important intellectual skill is profound. Already, Hay told the conferees, the time has come to question the value of memorization, even of such "basics" as multiplication tables.

The computer also suggests a significantly different role for teachers. "Think of what this does to teachers," Hay said. "We've been the experts, and we've been the experts for a long time. At one time, if I were the teacher it was because I had it up here. I lectured, you wrote it down, and then we tested to make sure that you had memorized it. Well, the book revolutionized teaching, and technology is in the process now of doing exactly the same thing."

For some, computers represent negative potential and cause for concern. "I know there are people out there who think that all kids in the future are going to have eyeballs shaped like TV screens and that there will be no human interaction," Hay said. But, he argued, "if you go into a classroom filled with computers and kids, there's more human interaction than you will find in most other classrooms.

"Most classrooms in the U.S. are 70 percent teacher talk, and noise interferes with that. That's why you've got to be quiet in the classroom, because it interferes with my communication to you. But in a room full of computers, there's tremendous interaction – kids working with kids, and the noise is not a factor. I think it's great! It's a tremendous tool!"

PRACTICAL CONSIDERATIONS

Despite Hay's enthusiastic endorsement of the computer in the classroom, he acknowledges, along with others, that persistent doubts and concerns remain, particularly since computers are an untried, untested instructional tool. Yet, while some still fear a future of introspective, robot-like students talking only to computers, most educators' concerns appear to focus on the practical aspects of bringing the computer revolution into the classroom: "How do we use computers effectively? Efficiently?"

Such practical considerations were of foremost concern among the conferees, as well. Their conversations revolved around a long list of questions about the rapid pace of technological advancement and the rapid obsolescence of computer equipment and programs; about when and how to use certain kinds of computerized instruction; about the process of changing from old structures and patterns to new; and about many other challenging issues related to technology.

Successful Change – A Question of Timing and Collaboration. How and when to introduce changes in public school programs was a topic of special interest – not only to the educators, but to business/industry representatives as well. Harvey Long, a consultant for IBM, and Barry Berman, representative of Monroe Systems for Business, urged educators to consider two very important factors when moving to bring computers into the instructional program: timing and partnership.

"Timing is very important," Long said. "Educational technology has not been a winner for many years, for many reasons." Schools seem like a natural place for computers, he said, and over 15 years ago, IBM attempted to launch a technology program aimed at the schools. "Unfortunately we were ahead of our time," Long said. "There wasn't the demand outside the school; there wasn't the commitment or understanding inside the schools; there wasn't the understanding in industry of what was needed; nor was it profitable. That's a very important point – in order for those engaged in marketing educational technologies to the schools to contribute, it must be financially successful."

Berman, describing an unsuccessful experiment of Monroe to develop a program aimed at

Barry Berman

Harvey Long

the schools, agreed. Although Monroe's program was good for schools, Berman said, it didn't work for the industry – and therefore it couldn't be sustained. Partnerships must be just that, the two men agreed – mutually supportive arrangements.

The solution to a creative, mutually rewarding business/education partnership, Long suggested, is the arrival of a third partner – the home. What's different about 1984 (compared to 1966 when IBM first moved toward school programs) is that there is powerful motivation outside of the schools – from parents, from employers, from students – for computer education. That demand will make the difference, he said. The timing is finally right.

Defining Terms: Computer Literacy. Among the issues before the conferees was the broad question of "computer literacy." Still an ill-defined term, it was a particularly sticky subject: "Who needs it?" "How does one acquire it?" "How much is enough?" And, given the rapid pace of technological growth and improvement, "How often does the definition change?" [See *Issue 3: Computer Literacy,* for a discussion of these questions.]

Learning About the Technology: Experimentation. Other questions concerned the problem of designing effective experimental programs to identify the strengths and weaknesses of computerized instruction. These questions are particularly challenging because equipment, programs, and information bases change so rapidly; because pressures outside the schools – parents, media, students, governments – make varying, sometimes conflicting demands on the schools with respect to computers; and because educational courseware development is far behind the development of either hardware or interest – and nowhere near the imagined potential of computer instruction.

Ethics: New Considerations for a New Age. There are ethical concerns as well about the emerging computer age of education. The computer's enormous potential to assist in the monitoring of student progress and learning, for example, raises some special questions. Heuston revealed that in the school he heads, "We're a little nervous about giving out too much information [in our learner profiles] – because we don't want to do what we did with the IQ. Do you remember? 'You are a 106' – stamped on your forehead. We are going to have to develop a taxonomy which will deliberately show where the talents lie and what that might mean – but not label people with problems."

Enacting Statewide Change: Two Options. How to introduce change on a statewide basis was another consideration of the conferees. Two rather different models, in California and West Virginia, were described [see *Issue 5*] and examined by panels of educators from throughout the region.

Paying for the Computer Revolution. A final issue of paramount concern to the conferees is that of cost – at a time of scarce resources, how to pay for the entry of the public schools into the computer age.

Directions

A NEED TO RETHINK INSTRUCTIONAL PRACTICES

Intense and far-ranging discussions about the computer led to suggestions for dramatically new long-term changes in public education, as well as important initiatives for educators to pursue in the immediate future.

- An activity already underway, and of the utmost importance, is the systematic exploration of the computer's educational potential. Clearly, testing, understanding, and harnessing the computer's capacities are important priorities for public educators. Such testing and experimentation must be done in a context of lean budgets and dizzyingly rapid technological change.
- The growing understanding of the potential of computers for education and the impact of computers on education suggest a fundamental reshaping of schools' roles and goals. The process, many contend, will come from outside the schools, unless educators take the initiative. Thus, a profusion of questions, options, and decisions confronts the school community.
- Closely related to the changing purposes of schooling is the issue of motivation. The discussions suggest that educators must not only reexamine why we educate youngsters, but how we motivate them to reach the goals that have been set.
- Ultimately, it appears, educators must move down a path which calls for a complete review and rethinking of instructional practices and beliefs. That rethinking includes beliefs about the "basic" skills required for today's educated citizen, the basic techniques used to impart those skills, and the basic performance expectations of the high school graduate or the public school teacher.

Because of the computer and other technological changes, Hay suggested, it is necessary for educators to eliminate from their vocabularies the words "always" and "never." Instead, he said, "We're going to have to rethink the very basics of what our teaching will involve."

- The wonderful irony which emerged from the conference discussions is that computers are an important part of the solution to the problems they pose. How to experiment broadly (and efficiently) with the potential of computer education? One way is to develop models and share the results — via computers and electronic mail — throughout the region. And computers offer the opportunity to further reduce costs through group purchasing and centralized delivery systems.

Likewise, computers offer powerful tools to educators seeking to motivate youngsters, as well as creative problem-solving aids in designing instructional practices.

Thus, key initiatives for educators, as the schools move into the computer age, will be various methods of sharing learning and skills; the active participation of educators in the process of shaping educational goals and directions; and the harnessing of the computer's capacities for creative planning, for motivating students, and for preparing staff for the new era.

THE WORLD INSTITUTE FOR COMPUTER-ASSISTED TEACHING SYSTEMS – An Experiment in Educational Technology

(Excerpted from a presentation of Dustin Heuston, Chairman of the World Institute for Computer-Assisted Teaching Systems)

One of the activities of the nonprofit sector [of WICAT] is running a research school called the Waterford School. The Waterford School is the only school in the world that is dedicated fully to experimental research in technology.

For those of you who are school administrators, I will tell you how I founded it. I used to lie awake in bed after my trustee meetings and think about how I could get out of all the politics, particularly if I wanted to do something innovative, like play with computers. My dream was to form a school that no one could get at. And I finally figured out how to do it. I located the school in Utah. I got rid of the trustee problem by making myself chairman of the trustees and putting the trustees in New York City. They meet three times a year. That's the first problem taken care of.

The next is various state education requirements which can sometimes come looming down from the legislature (whenever there's a new scandal, you get a new curriculum). We declared ourselves a private school and that took care of that problem.

Not that I'm not a fan of parent participation, but they do bully you sometimes and do drain time away from you, particularly if you're doing experimental work. So we have no tuition. It's a private school, but there's no tuition. If the parents don't like it, we just ask them to leave. I would like to share an interesting byproduct of this approach: the school has the highest morale of any school I've ever seen. There are 3,000 people on the waiting list. There's a message here, but one can't always execute it. But the point is, we finally have a research school where we can work with students without having real problems.

The first year, we kept the students off computers for the first semester after we started the school. (It's now K-9, and we're adding a grade level each year until it is K-12.) Our purpose was to have an entirely normal school in operation and then to add computers incrementally until we made very dramatic changes. We're up to about half an hour a day on computers using these big professional systems that we have developed. The preliminary results have been spectacular. We can't determine whether we have these statistics because Waterford is a good private school without political problems or whether it's the computer. That's not our job. Our job is to find out where you put the terminals, how long students get on them, whether or not students like the curriculum, and what helps the faculty members the most. Those are the research questions that we're addressing.

We know it works. That's not the issue. The first 20 years taught us that. The issue is to find the optimum way. Those lessons will then go out to the public schools – as soon as we have figurged out statistically and with our controls how it might best work. Then, as the profit-making corporation is selling systems to schools, the nonprofit is starting to track the research as those systems are placed. We'll begin to put a research network out that will track the schools we're working with to make sure that the materials are effective.

At WICAT – including both the profit and nonprofit – we've collected almost 40 PhDs from all over the world, and they are developing the materials. We have 110 people working full-time now, developing all these instructional materials. So we've managed to hit critical mass, and the school is the testing ground.

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2 The Issue:

Beyond the Computer—Skills for Tomorrow

Although the computer occupies center stage in the technological revolution, the profound changes we are experiencing in education go well beyond it. Of particular concern are the implications that technological change has for tomorrow's high school graduate. Today's schools, even with many recent changes and the rapid growth in the use of computers, continue to operate on beliefs formulated in a very different past. The beliefs include convictions, often embodied in state and local laws and policies, about the skills students will require and should therefore attain to successfully complete their schooling.

The conferees explored, in some depth, the issue of student competencies in a rapidly changing world.

Discussion
COMPUTERS NOT A PANACEA; MANY SKILLS ARE NEEDED

Pointing to a number of articles about the growing emphasis on computer literacy and computer use in the schools, staff of the Georgia Department of Education, in materials prepared by Jess Elliot, offered conferees a word of warning. "Probably the greatest danger from such a stampede [to the use of computers] is that the computer, and those things that relate directly to it, will crowd out other significant developments" needed to prepare students for life in the 21st Century in both a broad and balanced way.

Just what that balanced response should be was the focus of considerable lively discussion. At the core of the debate were many questions: "What does a high school graduate need to know/do to live successfully in a world . . .

" – where the information base doubles every 20 months?

" – where the majority of the work force will be employed in service rather than manufacturing jobs?

" – where increasingly sophisticated audio technologies may make reading skills decreasingly important?"

And so on. In 1980 a State of Washington school district did its own study of the future, and in the process identified some 35 aspects of the coming world which will reshape the nature of required student competencies (see box). Changes in family configurations and lifestyles, mobility, serial careers, and the increase in service employment all suggest a greater need for well developed interpersonal skills. There are profound implications as well for students as a result of increased leisure time, decentralized work and study, continuing growth of the electronic media, and scientific advancements in all areas.

Several major social changes, stemming from technological change, were the focus of special attention in the Georgia SEA staff report. One was the shift in the U.S. workforce from a labor market dominated by manufacturing to one dominated by service occupations. Ironically, most projections call not for a nation of "high technicians," but for a nation where 65 percent or more of the workers are in relatively low-skilled service jobs (waiters, sales clerks, janitors, nurses aides). While there is little argument about that projection, there is

CHANGES IN OUR WORLD in the 1980s

In 1980, the Lake Washington School District No. 414 in Kirkland, Washington, conducted a needs assessment and, as a part of that assessment, conducted a futures study involving citizens, students, and staff. They were asked about a variety of conditions which describe the world or the United States. Many of these conditions reflect broadly what many people think the future has in store. The conditions are listed below as a means of establishing a context for the student competencies which will follow.

In the World – In the 1980s

1. World resources, behavior, and opinion will have more influence on life in the U.S.
2. Underdeveloped countries will control their natural resources.
3. There will be world-wide recognition of the dangers of population growth and pollution of the biosphere.
4. The population will include a smaller percentage of children and a larger percentage of senior citizens.
5. Residential and work places will be located closer together to reduce transportation related problems.
6. Political and social pressure to improve the lives of senior citizens will have increased.
7. New information will continue to increase at an extraordinary rate.
8. Through developments in television, a large number of different channels will be received on home sets for purposes such as education, shopping, and community news.

In the United States – In the 1980s

9. *Operation round the clock, seven days a week, will be more common in manufacturing, retail, and service industries.*
10. *Shortages of things like energy and material resources will occur, often with little advance notice.*
11. *A higher proportion of the total labor force will be employed in pollution control and environmental protection activities.*
12. *A smaller proportion of the work force will be needed in goods-producing industries.*
13. *A larger proportion of the work force will be needed in service industries.*
14. *There will be more jobs for technicians than there are today.*
15. *More job descriptions will require people with human skills, i.e., openness, compassion, warmth, and tolerance.*
16. *Certification by demonstration of skills rather than by diploma, degree, or completion of prescribed training sequences will be in wide use and generally accepted in education, professional, and business practice.*
17. *A shorter work week and more leisure time will be the rule for most workers.*
18. Compulsory retirement at a fixed age will be enforced regardless of health, ability, or desire of the worker.
19. People will need to be more self-motivated and self-directed than they are presently.
20. Sexual relationships of varied types will be openly accepted.
21. Child-care centers will be much more numerous than at present and will provide developmental and educational experiences for children.
22. Many couples will divide bread-winning, household, and child-care duties on grounds other than sex.
23. It will be possible to achieve chemical control of many undesirable, negative, primitive, and aggressive behavioral tendencies in people.
24. There will be schools of many sorts with widely varying methods and organizational styles. Public schools will offer choices and students will be free to select the program and style of instruction they prefer.
25. Modes of teaching and learning will be more flexible utilizing computer-assisted, multisensory and yet-to-be-developed forms of instruction.
26. Futuristic studies will be part of the curriculum.
27. *Career education and work experience will be available for all students at some time during their public school experience.*
28. *Computer simulation, games, etc., will permit the students to practice career and management activities, in order to help them choose their adult roles.*
29. *Institutions will provide continuing education throughout life to meet changing personal and occupational needs.*
30. *Rapid changes in technology will cause many people to frequently retrain and change occupations.*
31. *Early childhood education will be provided by the public schools for most children beginning at age three or four.*
32. *The school curriculum will include instruction in skills for coping with a complex society.*
33. *Ability to read will be less important as a tool for gaining information.*
34. *Education in languages, world trade, and world history will be in more demand by students.*
35. *Learning opportunities for students will be provided throughout the community in business and social agencies, with the school serving to structure and coordinate the students' education.*

somewhat less agreement about what that means for the schools.

One opinion was expressed in an excerpt from a report by Levin and Rumberger, included in materials provided to conferees, on the "Educational Implications of High Technology." "[T]he expansion of the lowest skilled jobs in the American economy," the authors wrote, "will vastly outstrip the growth of high technology ones; and the proliferation of high technology industries and their products is far more likely to reduce the skill requirements of jobs in the U.S. economy than to upgrade them. Nonetheless, the educational system should strengthen the analytical and communicative skills of students, not because of the needs of high technology, but because such skills will help them deal with the changing political, economic, social, and cultural institutions they will face in their adult lives."

IRONY IN THE WORKPLACE

Projections about the work world lead to other conclusions as well. "I don't promise kids today that education will get them a better job and a better life than their parents," said Leroy Hay. "We have to realize that during this decade, upwards of 40 percent of all jobs that existed in 1980 will be eliminated by 1990. In 10 years, 40 percent of our jobs may be there, but they may not be in human hands.

"The irony," he went on, "is that in this high-tech age, 65 percent of the jobs are going to be service workers, and over half of those jobs are going to be for unskilled service workers."

For many, particularly those in industry, the projected working world, with its rapid changes in jobs, equipment, and techniques, suggests the need for high school graduates with very special skills. Georgia SEA staff, in their presentation, suggested these will include learning skills (permitting rapid acquisition of new job skills), interpersonal skills (especially desirable in service occupations), and well-developed decision-making skills.

Regardless of occupations, there is a consensus that some kind of computer skill/literacy is necessary, and communications skills beyond reading and writing also receive strong support.

Interestingly, at a time of major emphasis on high technology, many observers believe that high-tech training, and many aspects of vocational training, will no longer belong in the schools, but with business and industry.

DISCUSSION QUESTIONS
STUDENT COMPETENCY

1. *How can we — inside our own profession and the community outside our profession — go beyond the traditional student goals emphasized in schools today to include more cultural, societal, and personal competencies that seem necessary for the graduates of 1996?*
2. *What* **kind** *of changes will be required in the educational enterprise to facilitate the kinds of student competencies presented here?*
   - *Priority and emphasis?*
   - *What is taught?*
   - *How we teach?*
   - *How schools are organized and how education is conducted?*
3. *Respond to the present list of student competencies:*
   - *Is there an apparent organization?*
   - *Are there categories that are missing?*
   - *Are there specific competencies which should be added or deleted?*

VALUES, ETHICS and PROGRESS

Far more than computers are reshaping beliefs about student competencies. Keeping pace with scientific developments is a formidable challenge, suggesting to many a shift toward the study of major scientific issues and methods, with less emphasis on the accumulation of scientific "fact." Of particular importance, many educators believe, is the need for students to explore the values and ethical questions raised by scientific progress — topics such as genetic engineering, cloning, robotics, artificial intelligence, and energy conservation.

In addition to scientific developments, changes in family lifestyles, the pervasive and powerful role of mass media, and other developments have led educators and others to call for greater involvement of schools — formally — in the instruction and understanding of values.

These and other trends in opinions about appropriate 21st Century skills are reflected in a list of student competencies compiled by the Georgia SEA staff (see box). These computer-age competencies demonstrate the wide range of factors influencing contemporary society and reflect significant changes in many of the current policies related to student competencies. The list served as the basis for the conferees' discussions of student competencies.

STUDENT COMPETENCIES THAT REFLECT PERCEIVED NEEDS OF CITIZENS IN THE TWENTY-FIRST CENTURY

A Possible Listing, Prepared by Jess Elliott of the Georgia State Department of Education

Students should be able to: apply science, appreciate its impact on society, appreciate its applications to technology, understand the major issues in science, and comprehend the role of science in personal and political choices and decisions.

Students should understand the similarities and differences between human intelligence and the artificial intelligence of computers.

Students should understand and recognize in their own decisions the role of values and factual information in decision making.

Students should expect that periodic retraining for vocational reasons is a normal characteristic of one's career.

Students should understand that science is an evolving process rather than a single set of absolute truths.

Students should understand what scientific thinking is, why it is useful, and what its limitations are.

Students should possess essential computation skills and be able to apply them in daily life.

Students should understand the structure of mathematics, including the basic concepts of sets, numbers, and number systems.

Students should understand basic mathematical relations and functions.

Students should understand and be able to apply basic algebraic and geometric concepts.

Students should understand the basic principles of probability and how they apply in daily life.

Students should be able to use essential measurement and computing skills, including metric units.

Students should be able to communicate using mathematical concepts and measurements.

Students need to understand how society uses personal information that is readily accessible by computer to help individuals as well as to control them.

Students need to understand how to deal with the increased number of distinct cultural/ethnic groups that comprise the population of the United States.

Students need to understand how to deal with societal institutions through nonhuman communication media.

Students need to have concepts and skills, based on general systems theory, for understanding stability and change and for coping with complexity.

Students need a longer time perspective and the habit of thinking in terms of the consequences of possible actions and events.

Students need to be able to integrate ideas and information originating in diverse disciplines.

Students need to develop skills to address ethical and political issues such as: As technology evolves to allow more and more life saving medical care, how are the costs to be covered? Where do we set the limit on public sacrifice to maintain life for the chronically ill? What value do we associate with keeping people alive?

Students need to have an understanding of technological advances such as: genetic engineering, possibility of cloning, biomedical engineering, medical advancements that almost preclude clinical death, commercialization of space, industrial robotics, energy conservation, plant genetic engineering, and industrial computerized processes and mass production of diverse goods.

Students need to develop an appropriate work ethic, life ethic, and service ethic.

Students need to understand that careers and jobs will change because of structural obsolescence and that learning is necessary throughout one's life.

Students need to learn how to cooperate effectively with others.

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Students need to understand what computers may be used for.

Students need to understand basically how a computer functions.

Students need to understand how computers are programmed and have a preliminary knowledge of at least one computer language.

Students need to be able to use the computer in many of the following ways: to utilize data, to simulate real problems, to solve problems, to edit text and other word processor functions, to make decisions, to convey information in a usable manner, and to receive instruction.

Students need to recognize when, and for what reasons, American democratic institutions may be under stress.

Students need to understand that by the 21st Century, society will be global in nature.

Students need to appreciate the reasons why there will be increasing interdependence of groups and nations of the world.

Students need to understand the impact of the world population growth and the increasingly evident phenomenon of prolongevity.

Students need to understand the forces that foster the continuation of the arms race and encourage international anarchy.

Students need to understand the continuing disparities among the nations of the world and what kinds of crises result from them.

Students need to understand and appreciate the issues involved in these colliding values of different individuals and groups and how these groups compete in recruiting others to their values or ideologies.

Students need to understand and realize the importance of the Doctrine of Limits and how the need to conserve resources is applied to one's personal life.

Students need to understand the relationship between population growth and hunger and recognize how one might deal with it.

Students need to understand the impact of and appreciate the need for society to avoid ecocide.

Students need to be aware of the moral and ethical issues associated with the manipulation of genes in living things that results from gene splicing.

Students need to be able to examine their present, personal values in order to interact with others throughout our democratic processes as societal values are questioned and modified.

Students should be aware that democracy is a matter of degree in different cultures at different times.

Students need to learn and be proficient in using skills involved in arriving at group decisions.

Students need to understand the economic concept of "trade offs" and how it applies in one's personal life as well as on the societal scale.

Students need to understand how to use information systems to obtain needed information and how to avoid information overload because of increasing availability of large amounts of information.

Students need to learn and use effective strategies for seeking information, critically analyzing its relevance to an issue, and judging its validity in shaping one's personal decision about the issue.

Students need to understand the implications of the expected shift in the world economy from growth to a dynamic equilibrium.

Students need to understand and appreciate the need for voluntary frugality in one's use of resources as a means to reduce the need for enforced austerity.

Students need to be able to interact successfully with others who have differing ethical values and understand how to minimize any negative effects of the difference.

Students should appreciate the need for a transition from material values to a greater respect for human values.

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Directions
TIME TO DEFINE NEW BASIC SKILLS

Currently, the formal expectations of students — the competencies required for graduation — are more reflective of the 19th Century than of the rapidly approaching 21st Century. Indeed, recent emphasis on the "basics" of reading, writing, and arithmetic echoes the priorities of many past generations. Although conferees devoted little time to discussing the merits or demerits of the "3 Rs," there appeared to be strong support for the idea that there are additional "basics" for the educated person in the age of computers, and those "basics" deserve important places in public school curricula.

The first major sign of change is a rising interest in computer literacy and the addition of this term to the list of required subject offerings in many districts and states, even to requirements for high school graduation.

It appears, however, that computer literacy may be but the first step in a process of major change in public schooling. Consistently, conferees spoke of the importance of other student competencies — such as analysis, problem-solving, and information processing skills — to the 21st Century citizen. Furthermore, a great deal of the discussion suggested that forces outside the system — business, industry, parents — will lend increasing support to the movement to broad, balanced student competency requirements.

Some of the trends suggested by the conference discussions follow:

- *The growing importance of partnerships in support of the public schools.* These would include greater sharing of responsibility for education and educational decision making by parents and business, particularly in areas related to values education, individual educational career choices, and vocational and technical training.
- *Increased emphasis on lifelong learning* as a process, rather than on the high school diploma as an end.
- *Greater cooperation within the education community* — to share ideas, programs, and understanding and to support positive change.
- Finally, it seems likely that it will require the initial concerted efforts of educators and others to *expand the recent trend to reestablish traditional goals ("Back to Basics")*, and to bring about the necessary legislative and public support required for major philosophical change in the schools.

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3 The Issue:

Computer Literacy

The term "computer literacy" is commonly heard in educational and lay circles alike, and it is included by state education agencies and local districts among recommended and required subjects and competencies. Yet, despite (or perhaps because of) its widespread use, it is a rather elusive term.

Defining it, placing it in its appropriate place in the school curriculum, and devising schemes for evaluating it are among the tasks which confronted conferees.

Discussion
'COMPUTER LITERACY' HAS MULTIPLE DEFINITIONS

In very broad terms, there is quite a bit of agreement on the meaning of the term "computer literacy." Its major components generally include knowledge of computers and their history, computer vocabulary, applications of computers, hands-on experience, logic and problem solving, social impact, and sometimes values and ethical questions. There appears to be agreement that any definition of computer literacy must acknowledge *degrees* of literacy and must include knowledge of computers.

Apart from such general statements, however, virtually all specific definitions of computer literacy appear unique (see box). In a report prepared for conferees, the staff of the Louisiana SEA included 15 different definitions from state and local education agencies and from various commissions and consortia. They ranged from the Florida SEA's one-sentence definition ("Computer literacy is understanding use and effectiveness of computers in our everyday life and using a computer to solve problems.") to the Department of Defense Dependents Schools' two-page listing of program and instructional objectives. Concluded the staff report, "At the conceptual level, computer literacy provides a convenient way of referring to a diffuse collection of knowledge, beliefs, attitudes, values, and skills; however, the specific knowledge, skills, and attitudes necessary to qualify an individual as having achieved computer literacy remains uncertain."

Louisiana staff offered their own definition of the term — developed by the SEA for the specific purpose of assessing computer literacy levels.

IMPORTANT BUZZWORDS

Despite the vagueness of the term and the general agreement they are "buzzwords," most of the conferees seemed to share the Louisiana view that computer literacy provides a convenient way to refer to a broad range of skills, beliefs, and knowledge. Further, there seemed to be little disagreement that computer literacy — however one defines it — is important.

COMPUTER LITERACY

A Sampling of Definitions

"Computer Literacy is the knowledge of the capabilities, limitations, applications, and implications of computer technology. A computer-literate person is one who understands what a computer is and how it can be used to solve problems, who can converse in computer-related terms, and who has an understanding of the impact of the computer on jobs and society in general."

State of Louisiana

"Computer literacy includes awareness, literacy, and proficiency; it is a continuum of skill development which begins at an awareness level where one understands what a computer is and continues to a proficiency level where one understands advanced programming techniques in one or several languages."

Conferees, "Creative Partnerships in Technology"

"Computer literacy is understanding the use and effects of computers in our everyday life, such that one learns 'about,' 'with,' and 'through' computers. It includes: knowledge of capabilities, limitations, applications, etc., concerning computer technology and usage."

Conferees, "Creative Partnerships in Technology

"We believe that students in Virginia should develop the ability to understand the capabilities, applications, and implications of computer technology and use this knowledge to function effectively in society. Computer literacy instruction can be integrated into all subject areas, or taught in separate computer literacy courses."

State of Virginia

"Literacy is that knowledge needed to be successful in one's daily activities; it is one's ability to converse in various languages; therefore, computer literacy is ability to converse with computers — some type of minimum knowledge is needed, as computer literacy is a set of skills — it includes development of thinking skills and problem solving skills."

Conferees, "Creative Partnerships in Technology"

"Computer Literacy is understanding the use and effectiveness of computers in our everyday life and using a computer to solve problems."

Florida State Department of Education

"Computer literacy major components are: applications (uses), "hands-on" experience, logic and problem solving, social impact, and vocabulary; **must acknowledge** *degrees of computer literacy, and* **must include: knowledge** *of . . . but is a continuum."*

Conferees, "Creative Partnerships in Technology"

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More important than a consistency in definitions, many argued, was that a given district or state clearly define its own terms. Such clearly understood definitions are essential, it was stated, for effective planning, evaluation, instruction, and teacher training. For many, in fact, varying definitions were considered necessary, since "literacy" requirements vary from grade level to grade level, from district to district, and from child to child.

Although computer literacy may be defined differently for a first grader than for a ninth grade math student, virtually all agreed that it nonetheless belongs at all grade levels and in all subject areas. That across-the-board integration of computer literacy into the curriculum, however, also reflects different definitions and priorities for computer literacy. For some, integrating computer literacy might mean teaching about the development of the computer in history class, its vocabulary in English class, its social impact in social studies, and the operation of computers in a computer operations class. For others, integration may mean CAI in all subjects at all grade levels.

DISCUSSION QUESTIONS
COMPUTER LITERACY

1. *What is computer literacy?*
2. *Should computer literacy be defined differently for different groups of people?*
3. *Is computer literacy an educational buzzword?*
4. *Where does it belong in the curriculum?*
5. *Do you consider yourself computer literate?*
6. *How can computer literacy be evaluated?*

Finally, various opinions surfaced in the discussions of computer literacy evaluation. Several suggested a direct relationship between a definition including measurable objectives (in the manner of Louisiana's model) and any evaluation process. Others suggested the inclusion of attitudinal surveys and stressed the importance of using degrees of measurement for computer literacy. Whether evaluating or defining, warned one group, "involve all curriculum areas, all faculty. It's dangerous to rely on the same few individuals."

Directions
DEFINITIONS, MANDATES REFLECT PUBLIC CONCERN

Generally speaking, the discussions of computer literacy did not appear to raise many serious concerns or difficult questions among conference participants. Several trends and patterns were apparent from the discussions, however, and they may result in more challenging problems for educators in the near future:

- While many of the conferees were philosophical about the lack of consistent definitions of computer literacy (in fact, the "fuzziness" of the term was considered an asset by many), its elusiveness may pose special problems. As these "buzzwords" gain broader public acceptance and as pressures increase to include computer literacy in state and local curricula, the fear is that educators may have to contend with hastily imposed legislative mandates which limit the flexibility of schools to provide a range of computer skills education. This is of particular concern because of the many remaining questions about the appropriate and effective use of computers, and because the continually changing technology is likely to make today's "necessary" skills obsolete tomorrow. Many conferees encouraged ongoing involvement of educators in planning processes which would support schools' flexibility in providing computer literacy. In addition, sharing of information among the region's educators was considered a helpful tool in promoting flexible responses to demands for computer literacy.

- Training is another issue of major importance which relates directly to discussions of computer literacy. The implications for staff of across-the-board integration of computer literacy in all public schools at all levels are enormous. The need is clearly there for massive training efforts, but questions about who trains staff, when, how, and at whose expense remain to be answered.

4 The Issue:

Realizing the Potential—Making Technology Work in the Schools

The process of achieving computer literacy may begin with a definition of terms, but attaining that goal requires planning and program development in many parts of the educational process. To realize the educational potential of computers will require a solid foundation built on three key components: appropriate, high quality equipment, well-trained staff, and efficient delivery systems.

In each of these areas, educators are faced with major policy questions and critical decisions. Furthermore, as is true with most of the current technologies, the newness of computers as instructional tools and the rapid pace of change mean that many questions remain unanswered, and much experimentation remains to be done.

In exploring these three critical dimensions of educational technology, conferees focused in particular on standards and training to ensure teacher competencies, on the process of evaluating equipment, and on the option of networking as a delivery system.

Discussion
TEACHERS AND COMPUTERS— A POTENT COMBINATION

"Teachers want to challenge their students and feel professionally confident – both about their skills and their future jobs. Biases and fears must be overcome. And training teachers to use new equipment will reshape their perceptions of education. If well trained in the appropriate and creative uses of computers, staff can improve the educational program."

Thus, staff of the Florida Department of Education summed up some of the key issues related to teacher competencies in computer education. There appeared to be no argument among conferees that computers offered enormous potential to enhance and probably change public schooling. Equally common was the belief that computer literacy was an essential skill for today's teacher. Exactly what that meant, however, was a topic of much debate for the participants, who tackled such questions as "how to define teacher competency," " how to set performance and certification standards," and "how to train existing and prospective staff."

In general terms, people talked of the need for all teachers to "understand the computer as a tool, to use the computer for teaching and professional purposes, and to understand the world of technology." Computer literacy for teachers, most seemed to agree, involves more than the basic familiarity and skills required of students. For teachers, the terms "computer assisted instruction" (CAI) and "computer managed instruction" (CMI) have special meaning and imply an additional level of skill and understanding.

A list of teacher competencies suggested by J. Richard Dennis, presented in the conference materials by Florida staff, included such skills as "familiarity with computerized teaching materials," "the ability to apply computerized drill and practice in a variety of teaching situations," "the knowledge of how to use instructional games appropriately and effectively in teaching," and "the ability to draft specifications which set the needs and desires of the school and invite proposals or bids from potential suppliers."

DISCUSSION QUESTIONS
TEACHER COMPETENCIES

1. *How can we define teacher competencies? Should they encompass computer literacy and computer teaching? For all? For some?*
2. *Should states and/or local agencies develop performance standards for teachers in computer education? How can policies be modified to keep pace with the technology?*
3. *How can states and/or local agencies develop and evaluate quality teacher training programs? How can the successes and failures be documented?*
4. *How can states adopt standards for certification in computer education/science? How can states work cooperatively?*

Such competencies go well beyond the suggested literacy skills for students and reflect the general agreement that, if computers are to be effective educational tools, educators must be highly skilled in their use and knowledgeable about their strengths and limitations.

ASSESSING TEACHER COMPETENCY

Florida SEA staff pointed out that while a few states (e.g., Florida and the District of Columbia) have established guidelines and measures of teachers' competencies in computer use, for the most part, questions remain. Two such questions clearly represent high priorities for education policy makers in the future:

Certification. At present, conferees noted, certification requirements tend to deal specifically with computer course instruction, rather than addressing literacy requirements for all staff. That some kind of certification standards must eventually emerge seemed to be a point of agreement in the group discussions. But what those standards would be, and how they would be accomplished, was a subject of debate. Some suggested, for example, that certification standards be set for teacher training institutions rather than for teachers, to ensure that adequate instruction is provided for all educators.

Training. If every teacher requires a special level of computer literacy, and if competencies are expected of all in the use of computers for instruction and instructional management, there also must be adequate training opportunities for teachers — a second major issue.

"Unfortunately," the Florida SEA staff reported, "despite the recent explosion in instructional technology, teacher education has not kept pace." The staff cited six problem areas in computer education identified in 1980 by Stuart Milner:

1. lack of certification and requirements for computer related courses,
2. lack of training programs and courses,
3. lack of educators' knowledge of computer applications,
4. lack of incentives for teachers,
5. low priority given to instructional computing, and
6. the need for greater administrative commitment and recognition.

Since then, said the Florida staff members, "some of these problem areas have declined, particularly items three through six. Educators are more knowledgeable. Despite the general lack of pay incentives, teachers and administrators are filling available computer education classes. Many have received support from their supervisors and have helped to establish plans for action.

"Instructional computing is no longer a low priority. Educators are increasingly aware of both the demand for courses, particularly computer science in the secondary schools, and the responsibility of states to insure the quality of the preparation of such teachers."

Training and certification in computer education have progressed more slowly, however, they pointed out. "There are insufficient training programs and courses to fill the demand. State policies on teacher certification in computer education are still limited."

DISCUSSION QUESTIONS
SOFTWARE/NETWORKING

1. *Determine five components for a software evaluation form.*
2. *Identify types of individuals to compose a "team" to evaluate software for a state agency, school district/system, or school.*
3. *At the state level, who/what group should be responsible for coordinating a courseware review process?*
4. *List the major decisions to make in determining whether to use a networking configuration of microcomputers.*

Conferees agreed training opportunities for teachers are a matter of some priority – but consensus failed to develop of how those could best be accomplished. Many options emerged from the group discussions. Closer ties with higher education, perhaps in partnership with local districts, were recommended by many as an important key to addressing the training need. Incentives for teachers, such as tuition payments and/or extra pay, were suggested as helpful in bringing about widespread computer literacy. Others suggested making use of teacher centers or other staff development centers and programs. From the presentations and the discussions, it was clearly evident that teacher training in the new technology is important on both a pre-service and in-service basis – and additional funding is needed to support that in-service activity.

EVALUATING SOFTWARE

As the use of microcomputers has increased in the public schools, there has been growing concern and attention given to a new responsibility for educators – the evaluation of microcomputer software. There is a new awareness, North Carolina SEA staff reported to the conference, that the "micro user must begin to develop dependable, productive evaluation standards, for such standards will be the pattern from which the key for successful use of microcomputers is formed."

Currently, they said, the evaluation process is piecemeal, although there are indications of a growing interest in centralized evaluation efforts. Most often, software evaluation involves "practicing teachers writing the reviews." The North Carolina educators reported that teachers may collaborate in a group or work independently as members of a reviewing committee, and that different school grade level and content area educators may be involved in the process. However, teachers do not always review only programs intended for their areas. In fact, they said, it is "of concern that individuals without either content or grade level association to the software program are reviewing programs."

Who reviews software is a vital question – and so is the process of review. "A software evaluation process involves more than a group of willing reviewers. Procedures for obtaining the software for reviewing purposes, for coordinating the activities of the reviewers and the circulation of the software, for editing the reviews, and for disseminating the resulting document must all exist.

"Furthermore," the North Carolina staffers explained, "existence of such procedures is only the first step. Each and every part of the process must work smoothly and in unison with the other parts. Whether this occurs or not is dependent on the software evaluation form. How easy it is to use and what quality of reviews are being obtained will affect the entire procedure."

North Carolina's SEA staff pointed out that evaluation forms vary considerably in design, length, complexity, and style. They may be designed to fit index cards, a brochure format, or a regular sheet of paper. They may employ rating systems or open-ended questions about reviewers' opinions. The majority of forms currently in use, they said, combine a rating system with short, expository questions. What matters most, however, is

SUGGESTED TOPICS FOR SOFTWARE EVALUATION

General Background Information

Package Title, Version, Cost
Producer/Date, Vendor (if different)
Subject Area, Grade (ability level, specific topic)
Required Hardware
Medium (Tape, ROM Cartridge, 5¼" Diskette, 8" Diskette)
Type of Package (Single Program, Integrated Series)
Documentation Format
Instructional Approach (Drill and practice, simulation, problem-solving, etc.)

Evaluation Criteria

Does the program offer any advantages over the pedagogical methods?
Is the content of the materials suitable for the target population?
Does the content of the materials fit with curricular goals? Student instructional needs? Different learning styles?
Is the content accurate? Appropriate? Too limited in scope? Nonbiased/objective?
Are the objectives of the material explicit?
Is the program presented in an organized manner?
Is the content level consistent with the vocabulary and interest levels?
Are the support materials adequate? Accurate?
Does the program take advantage of the special capabilities of the computer?
Does the program provide stimulating, worthwhile interaction but is not limited to one-on-one interactions?
Does the software permit modification to meet individual student needs?
Does the material require extensive preparation or training?
Is the production of high technical quality?
Can a student use the program without supervision?

Overall Recommendation

Material is/is not recommended?
Rating (1-10)?
Appropriate for grade level(s)?
Subject area(s)?
Reviewer's name, position.

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not so much the format as whether it provides the user with a reliable means of evaluating a software program and also serves as a usable record for future needs.

"Not every educator or education agency will become a software evaluator," the North Carolina staff pointed out. "Yet, every educator working with microcomputers needs to establish at least a cursory evaluation process to use in selecting a software program."

NETWORKING

"Networking" is a term with a new meaning for educators, referring to a new means of providing instructional opportunities through a network of microcomputers. It is, explained the North Carolina SEA representatives, "one of the most significant, fastest-growing technologies in today's computer market."

Local area networking is a "data communication system consisting of a number of independent data devices (such as microcomputers) used to communicate with each other within a confined area." For educators, that means school or system access to centralized instructional programs, CMI systems, and data banks.

Three basic types of network systems now exist. Each has different characteristics, advantages, and disadvantages in terms of accessibility, flexibility, and cost.

- The "star" system connects microcomputers in a radial pattern to a central intelligent computer. If one of the computers is inoperative, the others will still work.
- A "daisy chain" is a series of microcomputers connected to a host. In this type of system, if one computer is inoperative, all devices beyond it in the chain will also fail to operate.
- The third type of network is called a "bus" system. It consists of microcomputers connected in parallel to a host with a single cable. If one device fails, the others will continue to operate.

The advantages of all such networks, the staff explained, are cost (they are relatively efficient ways of employing the technology), time and energy savings, and greater teacher control of the computer education process. Networks have disadvantages as well. They are not readily portable, are not always easy to use, and may have technical limitations that restrict use of selected programs. One drawback in particular deserves special attention. In a number of instances, software will not run at all on the network system, while other software may require special fees or extra hardware to be usable.

Ultimately, advised North Carolina's SEA staff members, educators need to examine the pros and cons of networking (see box) with a careful eye to their own system's needs and objectives before making a decision.

NETWORKING – PROS and CONS

Pros:
1. *Cost-efficient*
2. *Disk swapping reduced*
3. *Greater teacher control*
4. *Larger program base accessible*

Cons:
1. *Not readily portable*
2. *Limitations on amount of software available to run*
3. *Not always easy to use*
4. *Technical limitations – opening/closing of files*

Considerations:
1. *Which computer can be networked?*
2. *What is the minimum/maximum number of micros to be networked?*
3. *Which network allows upgrading and expanding to additional systems?*
4. *Which type (Star, Daisy Chain, Bus) of network is available?*
5. *Does the network require special operating software?*
6. *What is the greatest distance the network can extend and at what cost?*
7. *Is the vendor for the network controller and cables also the micro vendor?*
8. *Will the product be supported by on-going development, service, and support?*
9. *Can the host (master station) be used as a work station?*
10. *Should any of the slaves (micros connected to the host) be as capable as the host?*
11. *Can the system run copy-locked software?*
12. *Does the system use passwords or levels of access?*

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Directions
NEW SKILLS, STANDARDS NEEDED FOR TEACHERS

Discussions about the processes of bringing technology into the classroom reflected the essential purpose of the meeting — the sharing of ideas. Although still in experimental stages, the practical issues of teacher training, certification, software evaluation, and the design of delivery systems are very much a part of educators' day-to-day concerns.

Thus, conferees were able to share each others' experiences in these areas, to recommend successful efforts, and to caution against those that had not worked well. On issues such as certification and training programs, participants explored many of the options facing the region's educators in the near future, beginning the process of setting educational policy. Among the directions suggested by conference participants:

ENSURING TEACHER COMPETENCIES

There was no argument that if computers are to be a major presence in the schools, there will be performance standards for teachers related to the new technology. Furthermore, if there are performance standards, then certification requirements will surely follow, and the necessity of major training efforts will be greater than ever.

And what kind of standards will they be? They will most likely vary from state to state, conferees suggested. And it is likely there will be three major types of standards, reflecting categories of expected expertise:

- over-all "computer literacy" — a term yet to be defined, although roughly equivalent to the computer literacy levels expected of students.
- competencies which would permit teachers to use computers and other electronic technologies effectively in teaching students and in managing the instructional process — expertise, in other words, in CAI and CMI.
- specialized skills, training, and certification in computer education would be needed by some instructors. These would be teachers with responsibility for teaching computer skills, programming, and vocational applications of the technology.

Although definitions were not suggested, conferees seemed to share the opinion that all teachers would require competencies in categories one and two — at some level at least. The process of setting those standards remains a pressing concern for SEAs.

Additionally, if performance standards are required, conferees agreed, they would have to be reflected in criteria for certification. Just what those criteria would be, who would set them, and who would be evaluated are still questions without clear answers. Suggestions varied widely in both

practical and philosophical terms. Some believe that teacher training institutions, not teachers, should be required to meet standards in the areas of computer literacy. Others urged caution in moving toward certification requirements in any of the areas related to the new technology. Thus, an additional agenda item for the near future will be the development of appropriate certification guidelines at the state level.

Finally, if new skills are to be required of all teachers, they will need training. An important question facing area educators is who will have responsibility for such training efforts – which may be quite costly – and how such a system-wide instructional effort will be accomplished. Should the primary responsibility lie with the state? The LEA? The teacher training institutions? The teachers themselves? Which methods would be more effective – overall revision of teacher training programs in higher education? Incentives for teachers? Varied opportunities for instruction? (The latter option also implies widely different training programs, standards for completion, and skill levels of "trained" teachers.) Or should states assume full responsibility through statewide, state-funded, basic instructional programs for all staff? When funds are limited, how are they best used? What has priority?

Options and considerations were discussed in all these areas, making it clear that this very important issue still awaits state level resolution.

EVALUATING SOFTWARE

Given the pace at which computers are entering the schools, there is little doubt that software evaluation is an issue of priority concern to area educators. Conferees considered various options related to the topic and offered many suggestions and alternatives for dealing with that very important issue.

Three key questions under consideration were:

- What form/process should the evaluation include?
- Who should be included on the evaluation team? and
- Who at the state level should coordinate the process?

On the first point, there was strong agreement that evaluation forms should consider the appropriateness of content, technical construction, and – perhaps most important – whether the software addressed the purposes of the educational program. But many other considerations were also suggested, making for a long list including: cost, documentation, ease of use, reflection of principles of learning psychology, vendor support, response time, and availability of the software for preview.

Who should evaluate software? Almost all the conferees responding to that question urged that the ultimate user of the program be included in the evaluation process. That would include students in many cases, as well as teachers, administrators, parents, counselors – anyone using or with a direct concern about the use of the program. In addition, most urged that review teams include members with technological expertise as well as content expertise.

The question, "Who at the state level should coordinate the activity?" produced a wide range of responses, with suggestions ranging from permanent committees to ad hoc coordinating groups, with membership equally diverse. It appears policy makers have an interesting challenge ahead as they address the issue of software evaluation.

Key questions to be answered in the near future, as states move toward policies governing the selection of software, are:

- What level of involvement is appropriate for various members of the education community?
- What is the relationship of courseware review to textbook review and approval processes or purchasing policies?
- What is the role of education media specialists and instructional content areas specialists at the state level?

NETWORKING

At the heart of many of the questions related to delivery systems is a single issue – cost. And purpose is a second issue of major concern. Look first at the instructional objectives, conference participants advised, and determine if networking is an appropriate way of reaching them. Then check the cost: Is it an efficient way?

IN SUMMARY

Computer technology is already finding its way into the schools, rapidly in many areas and more slowly in others. For education policy makers, the task ahead is not to initiate change, but to manage it. Tasks include: to coordinate the many approaches ongoing at state and local levels, to identify effective programs and problem areas, and to begin the process of developing broad, systemwide policies and procedures.

5 The Issue:

The Process of Change—Two Approaches

How does a state move its schools into the computer age? In about as many ways as there are states. Because of different state priorities, policies, funding systems, and concerns, it appears likely that the process of change will be different for each.

Conferees explored two significantly different major statewide educational technology initiatives – those in California (where a new state law has established a comprehensive program of computer education) and West Virginia (where planning has begun to implement the computer education requirements of a sweeping new statewide Master Plan for public education). The two initiatives were different in many ways, including their roots, purposes, and the state's role in the process of change. Nonetheless, it was clear that there were similarities as well, especially in the emphasis on planning, collaboration, and efficient use of resources. From an exploration of these differences and similarities came many ideas about the process of effective change.

Discussion
CASE STUDIES: WEST VIRGINIA AND CALIFORNIA

In many respects, California and West Virginia have chosen radically different methods for bringing computer technology into the public schools. The California approach, explained Sharon Sprowls, a member of the state legislature's staff, is a state law — "The Computer Education Act of 1983" — stemming primarily from research of a legislative study group. Although the law calls for a number of statewide activities and establishes as a basic goal an hour per week per student of computer education, its heart is a program of matching grants to local school districts. This "Educational Technology Local Assistance Program" essentially provides funding support for *locally* developed plans.

In contrast, West Virginia's initiative responds to the requirements of a statewide Master Plan for public education, which in turn was developed by the State Board of Education to fulfill an order of the State Supreme Court. Nicholas Hobar, Assistant Bureau Chief for Policy and Organization Development, State Department of Education, explained that the technology initiative is intended to meet the Master Plan goal of ensuring that students will be able to function in a high-tech society. Furthermore, he pointed out, the Master Plan requires that computer literacy be integrated throughout the middle childhood and adolescent education curricula so as to help in the achievement of Master Plan learning outcomes for *all* program areas.

A major feature of West Virginia's program is a statewide educational computer network. When fully operational, the system (initially set up in 17 regional sites) will permit students to process information independently between and among districts, schools, and classrooms, as well as with a central library/data bank. It also will permit, Hobar said, the use of home computers to process information from local- and state-operated software libraries and will have the capacity to permit other agencies, such as institutions of higher education, to plug into the system for such purposes as teacher training and curriculum development.

While planning is an essential component of the systems in both California and West Virginia, the planning process is significantly different in each state. "Basically, " said Sprowls, "we've said to each school district, 'If you would like to expand or introduce the use of computers in your district, we want you to plan.' That's the real em-

Sharon Sprowls

phasis of this legislation." Individual district plans, she said, will be funded under the program with consideration given to equitable distribution of resources, incentives for individual teachers, schools, and districts, and identification of and support for model programs.

In West Virginia, comprehensive planning at the state level is the critical ingredient of the computer education program. The state Master Plan, Hobar explained, establishes not only broad goals, but, based on research, will include specific learning outcomes for students in all subject areas. "Student mastery of learning outcomes is the highest priority of the Master Plan," Hobar said. Therefore, all plans for the implementation of computer education flow from those learning outcomes. Decisions about all systems must be made in that context, he said. Delivery systems, organizational systems, choices about educational materials and teaching strategies — all will relate directly to the desired student learning outcomes.

In contrast to the direct bonds between West Virginia's technology program and its instructional program, California has taken a much more decentralized approach. The state's new education reform legislation has some references to computer education, but, despite hot debate, no requirement for computer literacy. Instead, the state education agency is assigned the responsibility of developing a model program in computer literacy for the legislature to review. Likewise, recognizing the great diversity among districts in terms of existing educational technology, California's legislation does not establish statewide instructional goals or a single statewide delivery model. Rather, the SEA is to play a key role in coordinating a variety of activities and particularly in sharing information on computer education throughout the state.

BUILDING THE NETWORK

In West Virginia, the State Board of Education took a different approach with its statewide delivery system. Based on the desired learning outcomes of the Master Plan and job training objectives, detailed specifications were developed for the statewide computer network, and bids were requested from major computer companies. IBM was awarded the contract to establish West Virginia's network, providing statewide consistency, although not precluding the use of other hardware within county school districts.

The emphasis, Hobar explained, was on ensuring that there would be statewide access and compatibility among districts and that schools throughout the state would have the opportunity to achieve the objectives of the Master Plan. "Our goal for the network is to have the system in place in every county in the state in the next year. And, in the third year (at least for now), the plan is to have every school — about 1,200 to 1,500 — in the system with at least one computer compatible with the network."

The respective roles of the California and West Virginia SEAs also are different under the two initiatives. As the agency charged with implementing the Master Plan, the West Virginia SEA has a major leadership role in ensuring that computer education is integrated throughout the state's instructional programs and that it will aid in achieving all learning outcomes. The agency thus has a key role in such areas as the development and selection of a vendor for the computer network model, establishing a "high quality" minimum level

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Nicholas Hobar

of activity in support of computer education in all districts, developing curriculum guides, and supporting teacher training programs.

California's SEA, in contrast, has a less direct leadership role, with primary responsibility as a "middle man" in the process of implementing the law. Among its roles: to serve as staff to the Committee which reviews and funds individual district computer education plans, to conduct research and establish models in such areas as computer literacy, to establish clearinghouses to serve districts and business and industry, and to help eliminate legislative and regulatory barriers to change.

The two states' initiatives are not without similarities, however. Perhaps the most important of these is the key role of a broad-based advisory committee. West Virginia's Task Force on Technology in Education was commissioned by the state superintendent to review the Master Plan and the state of the art in microcomputer and related educational technology and to "establish programmatic and fiscal alternatives for using technology to achieve the educational goals in the Master Plan." Some 30 members made up West Virginia's Task Force, including representatives of the legislature's leadership, a wide variety of professional organizations (teachers, counselors, principals, colleges of education, etc.), practitioners with expertise in technology at all instructional levels, the Appalachian Educational Lab, Project SLATE, and SEA staff with related responsibilities and expertise.

The Educational Technology Committee established by California's 1983 Computer Education Law is similarly diverse in composition. It includes representatives from business, industry, elementary and secondary education, educators well versed in instructional uses of computers, teacher preparation programs, instructional television, the state's Teacher Education and Computer Centers, the State Board of Education, and the California Public Broadcasting Commission. It has both the responsibility for studying and preparing recommendations on issues related to computer education and the ongoing task of reviewing and funding proposals under the Educational Technology Local Assistance Program.

(Though broad-based involvement was clearly a priority in both states, it is worth noting a significant difference between the two committees. The West Virginia Task Force served as an advisory committee to the Superintendent of Schools for a specific period of time and offered a series of recommendations for State Board consideration. The California committee serves on an ongoing basis, with the SEA acting as its staff, to implement the state legislation on computer education.)

EQUITY MEANS ACCESS

Another shared concern reflected in both initiatives was equity. "Access was something we were very concerned about when drafting this legislation," Sprowls said. "One of the major things that our study found was that resources have been distributed unevenly. Wealthier school districts tend to acquire equipment; poor school districts don't have the resources. Additionally, within schools, girls tend to have less access than boys, and minorities less access than whites. How can we give kids access throughout the state? How can we ensure kids have access in their own schools? Those have been major concerns of ours."

The importance of statewide support, not only in the education community but in the general

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THE PROCESS OF CHANGE
Components of the California Legislative Model for Computer Education

Last year, California's state legislature adopted the "Computer Education Act of 1983." Its fundamental purpose is to make computer education opportunities available to children throughout the state. Its basic approach is to provide funding and other support services to the state's local districts in their efforts to provide for the computer education needs of their students. Among its principal components:

- *Implementation of the law through a state Council on Technology in Education, including representatives of business, industry, computer technology, elementary/secondary education, teacher training institutions, instructional television, the state's Teacher Education and Computer Centers, the State Board of Education, and the California Public Broadcasting Commission.*
- *The Educational Technology Local Assistance Program. The heart of the legislation, this program provides matching grants to school districts for computer education on the basis of individual district's implementation plans.*
- *Additional grants to support software research and development.*
- *Small grants to students and teachers interested in developing particular kinds of programs, or modifying programs in their own schools.*
- *Some funding to provide for the purchase or development of specific types of software (e.g., math program for special education students) through the State Department of Education.*
- *Research and development funds to encourage teacher training in computer education at the post-secondary level.*
- *Market studies — supported by grants to regional occupational programs and regional occupational centers — of existing and projected need for computer-related skills.*
- *Further study by the Council on Technology in Education of the issue of employment preparation for high technology jobs, and to identify where such jobs are in California.*
- *Grants to support research and implementation of a television-based learning system for providing instruction in computer technology.*
- *SEA-developed programs for volume purchases and statewide software contracts to provide LEAs with discounts.*
- *Investigation of state and federal regulations and laws which may interfere with efficient use of computer technology in the schools.*
- *Exemplary grants for teachers — limited to $1,000. These bonuses will be for teachers involved in computer education who want funds to purchase a certain software program or piece of hardware.*
- *Clearinghouses — established by the SEA — for both LEAs and business and industry. Business and industry, for example, will be able to identify districts throughout the state where they may donate equipment.*

public and the legislature, also was emphasized by the speakers from both California and West Virginia. Pointing out that estimated funding requirements for California's legislation were $30 million each year, Sprowls stressed the importance of a statewide commitment to the program. "There's a real possibility that we will not get $30 million," she said. "The only way we will is if we have the input of teachers, parents, and superintendents telling the legislature that they think this is absolutely necessary, and it's what they want." That message was echoed in the recommendations of West Virginia's Task Force. In its final report to the State Board, it urged that there be a full, statewide commitment to the implementation of technology in education and that the legislature should place high budgetary priority on educational technology.

Both Sprowls and Hobar acknowledged a particularly challenging issue which remains unresolved in either plan — the question of software review and approval. "Software has been such a new development," Sprowls said, "that there hasn't really been that much content review. A lot of it is very sexist, and a lot of it is racist. There are depictions of people in computer software that would never be allowed in a textbook, so it's also been a concern to make sure that those things don't continue." The California SEA will be engaged in a variety of research and review activities related to software development and approval, although guidelines are not yet in place. Similarly, the West Virginia Task Force recommended a process for developing software review guidelines.

Teacher training also is a key issue. West Virginia's public school districts currently engage in a process of comprehensive needs assessment every three years and develop continuing education plans for their staff. These plans are submitted to the SEA for approval, funding support, and technical assistance. Hobar said that training needs in the area of computer education would be reflected in this process. The West Virginia computer network will also make opportunities available to link teacher training institutions with staff in the local districts. The California legislation relies on a variety of grants and incentive programs for local districts, as well as teacher training institutions. The incentive funds are intended to support model programs for staff instruction, including television-based learning systems similar to those used in several Western European countries, Sprowls said.

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VISIONS OF THE FUTURE:

From the West Virginia Task Force on Technology in Education

"I see a school data base system on a microcomputer which can be connected to the Department of Education main frame computer. The data include all information needed by the county and state administration for reporting of staff information, curriculum, textbooks, enrollment, and attendance, etc. No further reporting would be necessary. All data could be transmitted via telephone lines. In addition, reams of paper could be saved by electronic data collection and an electronic mail system. The hours saved could be well spent as a leader of learning. The money saved in supplies and mailing cost would help underwrite the cost of electronic information exchange."

"It was a typical day in the physics class. Sara had just entered her data in the computer for a graphical analysis of projectile motion when Bob signalled to Mr. Mullins, the teacher, that he had successfully completed his computer simulation of a landing on Mars. Meanwhile, Joe and Jennifer were discussing what action was needed to keep their nuclear reactor simulator under control. Suddenly the class mascot, Robert the Robot, announced that a special teleconference was ready to begin. Using the West Virginia Educational Broadcasting Satellite, Robert had linked the class' flat wall-sized TV to an earth station in Houston for a personal tour of the Johnson Space Center conducted by two of the astronauts. While the TV tour was in progress, a subcarrier wave transferred back to West Virginia a computer program for more accurately guiding the projector in our school planetarium."

"The opportunity for developing programs for students in small schools is limitless. A small school could easily have fewer than five students who request a specific class. The Department of Education could have that class available in a multi-media approach developed and taught by a certified teacher. Therefore, the school wouldn't need a qualified teacher in this area on staff. Lectures could be videotaped or transmitted by microwaves or carrier waves and picked up on both TV and microcomputer for interactive use. Other instructional materials could be packaged and sent to be used by the students as they work through the area of study. Any educator could be a facilitator for the students."

"The potential for developing statewide continuing education programs for all personnel in technology is exciting. The programs can be one-way transmissions and/or in an interactive mode featuring outstanding professionals in their areas of expertise. The ability to reach large numbers of people while not requiring a lot of travel is extremely important. Cost of the programs would be in the quality of presenters, not in hotel accommodations and gasoline. All personnel could be kept abreast of the most current developments in education."

"Teachers will have more information readily available to individualize instruction for each student, to provide remediation and reinforcement immediately at the point of need, to pace students depending on their needs, and to expand curricular offerings because the need can be determined statewide."

"An individualized educational program will exist for each child because performance data can be placed in the computer in order to design and develop individualized instruction efficiently and effectively. For example, physical education skill development and attainment information about each child can be stored and retrieved from the computer. Moreover, information about individual students can be used to schedule instruction according to the skill development or need in each subject."

"Students, teachers, administrators, and support personnel at the public school and higher education levels will be able to use word processing, electronic spread sheet, and data-based management computer programs to perform their roles more efficiently and effectively."

"The use of computers will not replace the need for an immediate teacher in the classroom. However, it will allow for greater access to vast information sources that are only available today via tedious search systems. The available use of computers will allow students to conduct simulations without high expense and/or dangers that would exist in real situations, thus providing information not normally available to make decisions, design innovations, and create inventions."

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THE PROCESS OF CHANGE

Recommendations of the West Virginia Task Force on Technology in Education

Responding to the requirements of a statewide Master Plan for Public Education, the West Virginia State Board of Education appointed a broad-based Task Force to address the issue of educational technology. In its final report to the State Board, in October 1983, the Task Force offered three broad recommendations and over 50 specific recommendations concerning such areas as software and hardware, organization development, education personnel development, curriculum, instruction, and management information systems. It also offered a series of "visions" about the future of public education in a technological age – visions which serve to guide the state as it moves forward to integrate computer technology into its school program.

Broad Recommendations

1. *The West Virginia Legislature, the executive branch of state government, the West Virginia Board of Education, the West Virginia Department of Education, the West Virginia Board of Regents, and county boards of education must be committed to the implementation of technology in education.*
2. *The West Virginia Legislature must place high budgetary priorities on technology in education when allocating funds to the West Virginia Board of Education and the West Virginia Board of Regents. New funds must be made available for program planning and the purchase of microcomputer hardware and software, as well as equipment and materials for other types of electronic delivery systems.*
3. *The West Virginia Department of Education must take a leadership role in:*
   - *developing learning outcomes and teaching strategies in terms of computer literacy, computer science, computer-assisted instruction, and computer-managed instruction in all programs of study at the early, middle, adolescent, and adult levels of general, special, and vocational education.*
   - *developing microcomputer assisted management and communications systems for the purpose of enhancing the role of educators to be leaders of learning.*
   - *developing innovative technological solutions to the problems inherent in the educational equity issue.*
   - *predicting organization changes and developing new patterns of structure which enable schools to function in the information age.*

Directions

PLANS MAY DIFFER, BUT SUCCESS ELEMENTS DON'T

In planning statewide systems of computer education, the choice of a centralized "top down" initiative or a decentralized "grass roots" approach will, of course, be made state by state, in response to the priorities, policies, and needs of the state. The California and West Virginia models, however, offer considerable consistency in terms of basic advice in engaging in a statewide process of change.

Assess Needs. To avoid having computers sit on shelves for lack of trained staff or to prevent inequitable distribution of resources, Sprowls advised the conferees to thoroughly assess the situation. California's legislation called for comprehensive needs assessment, including assessments of each of the individual district plans submitted for funding. Thus, the state will gain a clear picture of what equipment is being used, what programs are going on, and at what levels, how equipment and software are being used, and so on. Furthermore, Sprowls pointed out, each of the many different grant and incentive programs will provide the state

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with additional information about the state of the art in computer education in California. Funding for exemplary programs, software design, and the like will make the products of these activities available throughout the state, and the needs assessments will yield information for clearinghouses for LEAs, for computer business and industry, for teacher training institutions, and other concerned agencies.

Establish priorities. Without clear understanding of the purposes of programs in educational technology and without clear commitment of the education community and legislature, the likelihood of real success is small.

Identify existing resources. The effectiveness of the initiatives will be greatly affected by their efficiency. Many resources are already in place. Many districts already have and use computers, and business donations continue to represent important sources of equipment and training. West Virginia plans to make use of existing regional education service centers in its delivery system; California will plug into a system of Teacher Education and Computer Centers.

Provide staff training. "Given that the quality of technology in education is directly related to the competencies of educators, there is a need to review, modify, and create teacher education and staff development programs and certification criteria and procedures" to support the technology initiative, said the West Virginia Task Force. Its recommendations include assessment of teachers' skills, definition of computer literacy/skill requirements for teachers, and statewide training programs. Hobar explained that the statewide computer network will provide a key role in sharing information and training and in addressing staffing and training problems.

Sprowls said that training was a critical element of the Local Assistance Grants Program. Local districts will identify training needs and objectives, as well as proposed training programs. Other aspects of the California legislation will also have important parts in ensuring trained staff. A variety of incentive and exemplary grant programs will support training efforts and model programs. Additionally, an existing network of 15 Teacher Education and Computing Centers represents a valuable resource in providing training opportunities to LEAs.

Identify and remove barriers. The California SEA is now seeking exemption for software purchases from the state's competitive bidding regulations, Sprowls said. This is because the bidding system, designed for textbooks and other equipment, is a major problem in a state where districts are using dozens of different (and not necessarily compatible) computers. Another barrier to efficient use of technological resources is federal regulations concerning categorical funds. Sprowls pointed out that many districts have computers purchased with federal categorical funds which are idle much of the time because they may not be used for general school purposes. The State Department of Education is also investigating the possibility of regulatory changes there. The nature of the new technology, she said, may create unusual barriers to effective use. Planning should therefore include careful review of laws, regulations, policies, and administrative systems which might inhibit rather than aid the use of computer technology.

Ensure equal access. There was also strong agreement that, whether a system was state-mandated or locally initiated, the state has a responsibility to ensure equity in the distribution of resources and opportunities for computer education.

Collaborate. Sprowls pointed out that two major computer companies had donation programs in California, and two others are thinking about it. Furthermore, these companies want good information about where their donations are most needed. These are among the same companies, she said, who will be hiring high school graduates in the future, so there is also the need to be working together to identify the job skills required of tomorrow's worker.

Business and industry, public and private schools, elementary/secondary and higher education, public television, state legislators — these are among the principal groups that must collaborate if educational technology initiatives are to succeed.

Use the technology to spread the technology. One aspect of computer technology that is clearly recognized by both California and West Virginia initiatives is its enormous potential. The technology itself offers some of the best solutions to the problems of introducing it in the schools. California is looking at cable systems for providing teacher training in computer use, for example. West Virginia's statewide network will offer a highly efficient delivery system for computer education, electronic data sources, and teacher training. In fact, it is clear from both plans that the technology offers tremendous opportunities for solving delivery, training, staffing, and instructional problems in all areas of public schooling.

6

Next Steps—Forming a Regional Agenda

True to the purpose of the conference, participants focused carefully on final important questions: What next? How can we join in partnerships to bring about positive change? Despite the scope and complexity of the issues discussed, the conferees emerged from the meeting with a clear picture of what the next steps must be if the region's schools are to join the technological revolution.

THE STATE AND LOCAL DISTRICT AGENDA

For the individual states and local districts, three items form the framework for action in the coming year:

Information. The top priority for most was, clearly, information. There was a general recognition of the critical importance of expanding knowledge and understanding about computer technology and its impact on schools. Of greater value is information about what is working in their states and districts and elsewhere.

Although the conferees looked to the Southeastern Council to play the pivotal role in collecting and distributing information, it was also clear that information sharing and delivery systems were a high local priority as well. There was also general recognition that the means to effective sharing was – naturally – electronic technology.

Marshalling Support. Efforts to gain broad support for educational technology, for various purposes, will also be a priority activity for some regional educators. Legal and legislative issues related to computer instruction, purchasing, and evaluation were seen as important agenda items by some conferees. Others saw the need to build public and legislative support for technology-related programs and changes in the schools.

The high cost of new technologies was acknowledged by all as an issue of grave concern. Few suggested that fund-raising activities be an activity of immediate regional or local initiative, however. Whether educators simply plan to work within the constraints of limited funds or anticipate gradually increasing support for new programs is unclear. Some did suggest, however, that partnerships with industry may offer alternatives to the high cost of equipment purchase and staff training.

Partnerships. Partnerships were a final area where conferees saw an important role for state and local educators. "We are a consortium," said a member of one discussion group. "Let's consort!" Meetings and networking activities at the state and subregional level were suggested by some as useful means of sharing information and expertise.

THE REGIONAL AGENDA— THE SOUTHEASTERN REGIONAL COUNCIL'S ROLE

Three major roles were identified for the Southeastern Council in the coming year as an outcome of the October conference: information sharing, liaison, and planning.

Information Sharing. In keeping with the high priority conferees assigned to the acquisition of information on technology, the Council's role in coordinating information sharing was seen as essential. Recommended initiatives took many forms, basically described in five major areas of activity:

(1) *Publishing and/or disseminating information.* Among the specific requests for information were recommendations that the Council publish and disseminate papers by regional educators on various aspects of technology, papers describing the state of the art of technology in the Southeast, three-month updates of what is happening in technology in the region, and awareness information — for students and teachers — on the future of technology.

There was also widespread interest in information on exemplary projects throughout the region and on some of the mistakes and dead-ends resulting from experimentation with technology. Requests were made for information on resource people, reviews and evaluations of software and hardware, support materials and instructional packets in use throughout the region, and numerous special requests for information on teacher training techniques, models, materials, and policies.

(2) *A clearinghouse.* Similarly, there were many recommendations for the Council to provide a clearinghouse for certain kinds of information — especially sample policies, curriculum guides, state plans, evaluation programs, and other documents of interest throughout the region.

(3) *Conferences and forums.* Conferees recommended more of the same kinds of exchange forums and urged that Council continue to sponsor regional and subregional meetings on topics related to technology.

(4) *Subcommittee on Technology.* It was also recommended that the Council support a regional subcommittee which would provide direction and focus to the many dissemination and coordinating activities of the Council.

(5) *Research.* Conferees also recommended additional Council activity, to a limited extent, in studying and reporting on trends in technology, conducting surveys of regional and national activity related to computer technology, and interpreing data collected for use by educators in the region.

Liaison. A key role was mapped out for the Council by the conferees as a liaison with state departments of education and other key groups, including:

(1) *Liaison with the private business sector* — for the purpose of building partnerships between regional businesses and state departments of education, particularly to encourage businesses to share with education the lessons learned in their experimentation with technology.

(2) *Liaison with higher education* — for the purpose of building partnerships with individual state departments of education and state institutions of higher education, with particular focus on teacher training.

(3) *Liaison with computer and software vendors* — for the dual purpose of communicating the needs of state and local schools to the vendors and software developers and reviewing and then reporting on the offerings and capabilities of various vendors.

Planning. A final role for the Council was suggested only briefly, in the form of an invitation. It was recommended that the Council — and regional educators — consider the Council as an effective means of engaging in region-wide planning activities for the purpose of providing leadership in areas of policy and instruction.

A Nation's Schools in Transition

By LeROY HAY

Education is not falling apart; education is changing. It's changing because all of the institutions of our society are in the process of change right now, because what we are experiencing is a decade of transition, a decade that will take us from the industrial era into what global futurists are now labeling The Age of Information. If we can believe history, we are going to experience what we experienced in our society when we went from the agricultural age into the industrial age, a revamping of all institutions. But what's different this time is that change is moving so much more rapidly than ever before.

What I want to do for the next few minutes is to share with you some changes that I see coming our way, particularly as they relate to learning and technology — and ask you to do one thing. For the next few minutes, I would ask you to eliminate from your vocabulary the words "always" and "never." Instead of saying "That'll never happen," or, "Well, we've always done that," consider for a few minutes the "what if's." What if even half of these projections are correct; what might this mean to education? What it will mean, of course, is that we have some rethinking to do.

Consider, for example, the recent reports on schooling by the Carnegie Commission and the National Commission on Excellence in Education. I've spent some time with those reports, and what I find is a common thread woven through all of them. They are all saying that now is the time for educators at all levels to stop and redefine exactly the business that we're about: the very basic business of education.

What I am talking about, indeed, is a totally new era of mankind. John Naisbitt has helped to make us all aware of this in Megatrends, *which is still up there on the Best Seller List. In* Megatrends, *as you may know, Naisbitt points out that information is doubling in our world every five and a half years. That was back when he wrote the book. But the projection is that computerization has moved so rapidly that our world information base is now doubling every four years. At the rate we're going, there's reason to believe our information base soon will be doubling every 20 months — every 20 months! I hope you realize what that means. It means that you are getting dumber every second. While you're sitting here right now, you're getting dumber. I know there's no such word. I'm an English teacher. But what I'm saying is, if you assume that intelligence is the percentage of the world's knowledge that you carry around in the brain, the percentage is decreasing very rapidly.*

You and I are in a business that has always claimed to have control of information and knowledge. We've been very much oriented to that kind of thinking. I'm suggesting to you that something as simple as the impact of technology on how much we need to learn has to be investigated for several reasons.

Number one, consider how the Carnegie Report defined literacy. The Carnegie Report says that once upon a time you were literate if you could write your name. That's all it took to be labeled literate. No one here is going to argue that that's not good enough today. All right, consider a later definition: it's not enough to write your name, you've got to be able to read and write. But I don't think you'd buy even that today. Today most of us would say that to be labeled literate, you have to be able to read, write, and compute. You've got to do arithmetic. But the Carnegie Report suggests, and I'll suggest to you, that even that's not enough today, that we've already moved into a fourth part of literacy, the ability to retrieve and process information. If we are turning out kids today who are not capable of knowing how to ask the right questions and to access information and then to know what to do with it once they get it, then we're doing a disservice.

Let me underscore that by telling you something that I picked up in Washington at the Library of Congress. One of the librarians pointed out that our Library of Congress is not a repository of world knowledge. A lot of people in this country assume that, but the truth is, the Library simply could not keep up with the knowledge of our world. As a matter of fact, it's not even a repository of the knowledge that's produced in this country. The Library is very selective, because it's had to be. Something has gotten in the way — storage. Books take up space. So your Library of Congress is in the process of switching over to discs. It has already put its card catalogue of five and a half million cards onto 24 floppy discs. The next step is to put the entire collection of the Library of Congress onto discs so that each of us will have access to it in our school library, in our town library, and, certainly by the beginning of the next decade, six and a half years away, off a channel on our television set.

The point is, we are moving into an era where access to knowledge is no longer going to belong to those who used to have control of it at the university, at a research university, or at the corporate level. That knowledge is going to be available to all of us if we know how to deal with it. And notice, the librarian didn't say that we all have to be computer experts. I'm a bit concerned when people think that information processing or information retrieval means you have to be a computer programmer, and there are some school districts that are rushing out there to make sure that every student has to take computer programming. If we turn out a nation where everyone is a computer programmer, we're simply going to have a nation of unemployed computer programmers. No, that's not what is important. I'm not saying we don't need computer programmers. What I am saying is that we're going to have to learn how to access information and then know what to do with it when we get there.

But think of what that does to teachers. We've been the experts, and we've been the experts for a long time. Once upon a time there was probably a discussion in the teachers' lounge that went something like this: "Did you hear what happened? Somebody invented a printing press. It's all over. Not going to need teachers any more." And that's exactly what a lot of teachers thought, because at one time if I were the teacher, it's because I had it up here. I lectured you wrote it down, and then we tested to make sure that you had memorized it.

ANOTHER REVOLUTION

Well, the book revolutionized teaching, and the technology is in the process of doing the exact same thing. How much? Let me share some very recent projections. Some of you may not even have caught up with these. I spend a great deal of time researching, but I am not a computer expert, so I'm not sure I can explain exactly how this was done, but the Harris Corporation of San Bernadino, Calif., just succeeded in putting a 16-byte microprocessor on a chip the size of your thumbnail — and that's the entire unit. This means, according to John Naisbitt's group, that the age of the pocket computer is upon us about six or seven years before we thought it would be. These will be on the market probably within two years. Instead of waiting until the next decade, in this decade we will begin to see the next step in the 1980s. I'm talking about computers in wristwatches. Soon the kids will come into your classroom not only with a wristwatch that tells time in several time zones, plays music, and has a Star Wars game and a calculator, but one that is also a computer.

> *"What is the role of memorization in the teaching and learning process?"*

Let me take it to the other extreme for just a moment. We're now beginning to get some public information about the other end of that scale — supercomputers. Our fastest computer in the United States is the Cray XMP. It will handle 400 million operations a second. I don't even know what that means, but I will say for comparative purposes that the Apple II can handle 5,000. The projection is that within seven years the Japanese expect to be marketing a supercomputer that will handle ten billion operations a second — ten billion! (I don't know about you, but I choose not to doubt the Japanese. I fully believe that they will do that. As a matter of fact, I've just finished reading a book called Fifth Generation, *which is an overview of the possibilities of computers as we move into this new era. According to the book, the Japanese are underway right now, and some American corporations are beginning to realize that they had better follow suit.) Ten billion operations a second! What that will mean is that we aren't going to be sure that even the knowledge base we had yesterday makes any sense today.*

IN THE ANSWER BUSINESS?

For example, something significant is happening this week in the field of genetics. Plants die when you have a frost, right? Well, they used to, but that is changing. A genetic laboratory in California (one of five hundred in this country now) has produced through genetic engineering a bacteria that impedes response to freezing temperatures. They showed a lab experiment where they took two stalks of corn, one with the bacteria on it and the other without, and put them in a freezer overnight. Of course, the one without is dead and the one with the bacteria is perfectly alive the next morning. Now they're going to treat an entire field to see the response. That's the beginning.

What I'm saying is that we must begin to question whether or not we are in the answer business. We're going to have to ask a question as basic as this: What is the role of memorization in the teaching and learning process? Some of you may remember an experience like mine. I spent three wonderful days in Cortland, N.Y., as a junior, in an English class where one at a time we came up behind a podium and recited, "Tomorrow and tomorrow and tomorrow creeps in this petty pace from day to day, . . . " and I see the nodding. A lot of you did the same thing. It was a process we were going through to make sure that we could memorize.

I'm not here to say that memorization is no longer important, but we're going to have to rethink it. I love saying this to elementary teachers, because it gets them excited, but you know it's true that we really do need to question something as basic as multiplication tables. Must *you memorize the multiplication tables? (Now, remember, no "always," "no" never.)* Why *must you memorize the multiplication tables? Well, to understand*

multiplication. Right? Maybe not. Mathematicians say that's not necessarily so, that you don't have to have them memorized to understand the concepts. Now, maybe memorizing the multiplication tables make sense, but they don't make sense for their own sake. You certainly aren't going to get by any longer saying, "Well, it was good enough for me." We're going to have to rethink the very basics of what our teaching will involve.

80 MILLION COMPUTERS

We're also going to have to go beyond that. We have to recognize that even the everyday computers that we have now, our Apples and our Ataris, are becoming very common middle-class household utilities. The projection is that by the end of this decade one out of every four American homes will have a home computer. As a matter of fact, a projection from the industry says that somewhere around 80 million people will be buying home computers this decade for the purpose of learning – not for games – for learning. And the focus is very definitely on children. There are five new computer magazines either out now or that will be out within the year aimed just at children.

As we continue, we're headed into a fifth generation of computers. Let me share a couple of projections from the computer industry. I don't know if you've heard the term "KIPS" yet, but that is what the fifth generation of computers is going to be called. The Japanese coined the acronym for the advanced computers, and we're going to use it also because we won't want to call them computers. KIPS stands for "knowledge information processing system" – something that goes beyond simple computing. As the name suggests, it means that we're going to see a shift from merely processing data to the intelligent processing of knowledge. In effect, what the industry is saying is that the burden of producing the future knowledge of our world is going to be transferred from the human head to this machine. Yes, I'm talking about that old science fiction term "artificial intelligence." I'm talking about a machine that will reason, draw conclusions, make judgments, and understand both the written and the spoken word.

As we move into this fifth generation of computers, we'll require no expertise or programming ability because you can sit right down and talk to the computer. As a matter of fact, they project you're going to be able to give it handwritten information, and the machine will be able to read it. These are going to be expert systems. They're going to do exactly what you and I do – take a body of knowledge, apply to it our experience,

> *"... the machinery will be capable of making ... one million inferences a second."*

and then make some inferences. The aim is to make this machine work by having chips with 10 million transistors on them (the Japanese say they'll have them this decade, to make a machine that will understand spoken Japanese or English with a vocabulary of 50,000 words with 95 percent accuracy. Ultimately, it will allow us to have a KIPS that is a doctor; a KIPS that is a library – if you go in to seek information, it will be able to infer your needs from what you have said; a KIPS that is an intelligent tutor and an intelligent newspaper – knowing fully what you like and picking out materials that it thinks you will like; KIPS that are knowledge simulators; and active two-way communication – within this decade.

INTELLIGENT TOOLS

Now I know that very often the response to this is "Well, it can never replace the human being." The intention is not to replace the human being. The technology is meant to be a tool. This quote from a professor at MIT named Edward Fredkin sums it up, I think. He says,

Humans are okay. I'm glad to be one. I like them in general, but they're only human. It's nothing to complain about. Humans aren't the best ditch diggers in the world. Machines are. And humans can't lift as much as a crane. And they can't fly at all without an airplane. And they can't carry as much as a truck. It doesn't make me feel bad. There were people whose thing in life was completely physical, John Henry and the steam hammer. Now we're up against the intellectual steam hammer, and the intellectual doesn't like the idea of this machine doing it better than he does. But it's not different really from the guy who was surpassed physically.

If you stop to think about it, that's really where we are. I'm told that the limit of the human mind is four unrelated ideas at any one time. That's about the most that we can handle. However, the machinery is going to have unlimited capability. As a matter of fact, that machinery that I'm talking about – that the Japanese are talking about, and the American industry is talking about – will be capable of making close to one million inferences a second. That is the same process that you and I go through, but much faster.

I'm not worried about the impact that it's going to have on us as human beings. I know that there are people out there who think that all kids in the future are going to have eyeballs shaped like TV screens and that there will be no human interaction. You're educators – you know if you go into a classroom filled with computers and kids, there's more human interaction than you will find in most other classrooms. As a matter of fact, the Goodlad study that's out now says what I think is pretty much descriptive of the classrooms that I've seen. Most classrooms in the United States are 70 percent teacher talk, and noise interferes with that. That's why you've got to be

quiet in the classroom, because it interferes with the teacher's communication to the student. But in a room full of computers, there's tremendous interaction; kids work with kids, and noise is not a factor. I think it's great! It's a tremendous tool!

SPELLING FOR SAM

I know there are doubters out there. How fast can this technology really come on board? Let me tell you a story that happened to me last year. In one of the courses I teach — a Theater Arts Course — I require a major paper at the end of the year. At the end of the first semester I assigned the paper and received a phone call from a parent who said, "Dr. Hay, this is Sam's father. We've just purchased a word processor." Well, of course, being a futurist, I said, "No problem." In addition to that, I had seen Sam's handwriting, so I said, "No, no problem at all."

He said, "Well, I should tell you though, we've purchased a spelling dictionary, and it's on the computer too, and it will correct Sam's spelling at the rate of 40 pages a minute." (Now I hope you all have sympathy for Sam. He has the old version. The first version that came out just said, "This is not in our dictionary. It's misspelled. You find out how to spell it." The new ones which are out on the market right now, as you probably know, will offer you several alternatives that the program thinks you meant, so that you don't even have to go searching.) I tell my students — and have for a very long time — to proofread their papers when they're outside of class, and if spelling is a problem, then get their parents to do it. So if Sam has a machine that proofreads, fine.

Well, two additional computer programs have come out for Sam's machine. One is a grammar unit. It will go through and find errors in grammar, punctuation, capitalization, and verb tense. The second one — which I find even more fascinating — will go through and map out your sentence structure, tell where you have fragments or run-ons, and also tell you if you have a pattern of using compound-complex sentences, to vary your sentence pattern.

"Would you mind if Sam used those if we purchased them?" Sam's father asked. Well, I did think a little bit longer about that question, but, I'm an educated person, and I know there's absolutely no research to correlate any relationship between writing and grammar and spelling. Grammar and spelling are important for one reason, but they do not make you a writer. So I said, "I wouldn't mind."

He said, "Well, there is one more thing. The company expects to have within the year a thesaurus that will go through and analyze the pattern of words in your papers and then offer you alternatives when it finds that you're repeating the same word over and over. Would you mind if Sam used that if we purchased it?" I had to think twice about that one. After all, choice of language is such an important part of writing style. But then I realized that for 17 years I've been trying to get kids to use a thesaurus, and if I say, "Today you will proofread your papers. Here's a thesaurus," they'll do it. So I realized that in effect what I was talking about was something Sam could have done on his own but was never going to do. So I said, "Sure. Let him use the thesaurus."

THINKING MUST CHANGE

There's another part of this story that I think you should know: Sam is learning disabled, and he has been in a learning center in our school system since elementary school. A very bright young man, he has some problems that he never really will overcome, and he had not done terribly well in junior high and high school, because a lot of his subject teachers just simply couldn't work through his handwriting and his errors to get to the content. Since he began using the computer, his grades have gone up remarkably. Think, if that works for him, what it's going to mean to the student on the other end of the scale.

So I'm saying to you, let's not be afraid of the technology that's out there. Let's be open-minded about it. I'm not worried about the kids. I worry about those of us who have those preconceived notions that, for example, spelling is a symbol of intellectualism. We were brought up with the idea that if you misspell words, it's a negative comment on you. That kind of thinking can be a real problem, I believe, given the kind of change going on.

Let me give you an example of what I mean. Let's look at some projections about voice synthesis. Now I realize tht you were supposed to have your voice-activated typewriter already. The original projections were that we would have the voice-activated typewriter by the early 1980s. They were wrong. The problem is, you have a bad habit down here of saying, "Y'all come on down," and up where I'm from, they "pa'ak the ca'ah." They thought that they could program

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in enough of all the variances, but you know those speakers who sit down and —un—when they—uh—talk they . . . uh . . . put in a lot of "uh's." Well, you know what? The typewriter prints, "Uh, uh, uh." So voice synthesis was put off. Oh, you can buy a voice-activated typewriter today, but it must be programmed to your voice. You have to sit down and read in a whole list of vocabulary so that it will then respond just to your voice, and industry's not even going to buy that.

It appears now that what is going to happen is that, in a year or two, until we can program all of those variations, the first voice-activated typewriters for business and industry will be coming out, and we will have to learn to speak to the technology. In other words, if you want to activate that typewriter, you are going to have to eliminate the "uh's," and unless we regionalize it, it's not going to know what we are saying if we "pa'ak the ca'ah." So we are going to have to adapt.

TALK TO YOUR TYPEWRITER

Nonetheless, **within this decade,** when the kids go home to do their homework, they are going to sit down and do it by talking to the typewriter. It is going to spell all of the words exactly as they are supposed to be, and it's going to know which "to" you mean, from context. So I'm saying, spelling may be important, but its importance is about to change. So are a lot of things.

Let's consider now another set of technologies for just a moment — video texts and telecommunications. I've done a lot of work in this area recently, because I'm going to address a number of reading organizations and groups of English teachers this year since I am a teacher of English. I sat down to take a look at the whole concept of communication. That includes reading, writing, and arithmetic. They are all communication — with a different set of symbols, perhaps. I focused on reading and writing in particular, and what I realized is that the kids that I'm teaching today are oriented far more to an image than they are to a word. I think most of you can understand that.

We are teaching true television children. I know you are all educators, so you don't watch televison. You hear that in the teacher's lounge all the time. Teachers are very elitist about it: "I only turn it on once a week, and that's for Sixty Minutes." That's what I say too. Well, let me tell you, those kids are turning it on more than just Sixty Minutes. The average American viewing time is somewhere around 30 hours of television a week, and the telecommunications industry says, by the end of this decade it will increase to 40. That's their plan. We know for a fact from research that the only activity that children spend more time in than sleeping is watching television, and school and learning don't run even a close third. **Our kids are oriented to the image.**

Yet they come into the school system, and we promptly ignore it. Oh, we do show some movies, and we do use some audio-visuals, but there are not many English classrooms that actually look at the process of handling images, which I think are very closely related to reading. Reading people are going to have to catch up with this very soon, but we're going to have to think about communication in very different terms.

WRITING: A SURVIVAL SKILL?

Well, I picked on reading. Let me pick on writing for just a moment. Kids hate writing, they really do. Unless I say, "You will do a rough draft; I'll check it off; then you'll rewrite it," kids won't do drafts today. It's a pain, because part of our problem today is that we're still selling writing as a survival skill. Now I'm ready to make some real enemies because I'm going to tell you that, once you get out of the academic world, writing is not a survival skill. You can survive very well in this world and not be a good writer. When you're out of the academic world, less than two percent of the average American communication is ever done in writing, and that percentage is going down all the time.

Writing is important because it is a thinking skill, and we have made the mistake of trying to tell kids that you can't survive unless you can write an essay. You know where you write essays: in college. So I tell my students that I'm teaching them how to write essays because it's going to help them organize their thinking and because they're going to have to do it in college. We even have to rethink the role of writing in our society today.

Notice I didn't say writing is not important; I said it is not a survival skill. Most Americans do not have to communicate in writing, but they have to think, and it's an excellent way to teach thinking. So if the telecommunications industry is correct, what I'm suggesting to you is that all of these basics need to be expanded.

It goes even beyond that, because

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> "... the middle class American, by the end of this decade ... should have an honest-to-God metal slave right at home."

so much of what you and I have traditionally known is going to be reshaped by the telecommunications industry. The industry expects that the average American will have in his or her home by the end of this decade a telecommunications room with 100+ active channels of television – and not just ABC, CBS, and NBC. There are several cable systems right now around the country that have 60 to 70 channels. You've seen all the specialized networks that have come out, and you are going to see even more of them. You've probably been reading about the big court cases going on right now. The only thing that's holding back old fashioned porno on your television set is some legal issues. We've got children's networks, music channels, and soap opera channels. But that's just the beginning. The telecommunications system will also be used as your mail, and your newspaper, and certainly you're going to use it to shop.

SHOPPING BY TOUCH

In the KUBE system this fall in Dallas, Texas, you can turn on your television set and order from your Sears store. They took the old-fashioned catalogue, put it on discs, and you've got a Sears channel. You sit down and it says, "Good afternoon. Welcome to Sears. What would you like?" So you type in, "jeans," and it'll ask you some questions. "Well, are you interested in men's, women's, boys', girls'? What size? What color?" It will show you. Hook it in with your telephone and your jeans will be delivered.

There are at least two experiments in the country that let you shop for groceries off your television set, right now. If you are one of those strange people who truly enjoy going to the grocery store, they will keep a few grocery stores open. For most of us who find it just really gets in our way, we'll be able to sit down, and just tell that television set what we're interested in. It will show you the very latest of what's available, and you will have your groceries delivered at home.

There's another technology that, added to the telecommunications systems, will change our ideas about basics. I'd like you to consider just for a moment the concept of robotics. Now here's another projection that was off. You were supposed to be here today, according to many forecasts, while your household robot was doing the cleaning at home. Now I doubt if anyone here left a robot at home to do the dusting. Projections were off because a major problem in robotics hasn't been solved. That is touch. The second generation robots will have senses. They've solved two. Technologies for robots can now process visual images, and they can now process sound.

And now the people at MIT think that they have solved the problem of providing robots with a sense of touch. According to Joseph Engelberger, who was the president and founder of Unimation in Danbury, Conn., the largest robotics company in the United States, "Thanks to what is going on at MIT, the middle-class American by the end of this decade, within the next seven years, should have an honest-to-God metal slave right at home." It will be there to do any kind of household chores that you choose to program, and I'm saying now, with the sense of touch, it can lift up that vase and dust underneath, and it will not crush it.

Well, I mention this not because I want you to be frightened by that possibility, but simply to consider the impact that it will have on the lives of our children. I have two children, and part of their being involved in our family is that they do some of those nasty chores around the house. It's part of membership in our family. And if we talk about the work ethic, think of the implications there are if we can simply have a machine programmed to do what little physical labor there is around our house.

CREATIVITY and CHANGE

So I would suggest to you as you rethink basics, you want to rethink what the futurists call the coping skills. Today in our school system we go far beyond reading, writing, arithmetic, information retrieval, and information processing. We serve a lot of needs of kids today that are absolutely essential survival for them, because they're not getting that support anywhere else. As we move into these technology areas, as our lives continue to change, they will need even more and more help learning how to take care of themselves physically, psychologically in response to change, and emotionally.

They also will need help in learning how to be creative in responding to this world. I really worry about school districts that label music and art a frill because, I would ask you, where are kids expected to be creative today? Certainly I don't think any of you are going to argue that the television set requires creativity. If you haven't been in a toy store for a while, make a visit, because I'm telling you that toys don't require creativity any more. And, since industry says that we can expect even more kinds of electronic toys, this is just the beginning.

So all of us have to stop and rethink what we really expect our school systems to do in response to what is coming. The bottom line of this, of course, is students. Perhaps the most important message I want to give you has to do with the students. I'm convinced that students are choosing not to learn today. I think we were rather naive; we didn't even consider it an

option. But kids come in today, and they learn if they so choose.

Part of our problem is that we still are trying to sell education the way it was sold to us. My favorite definition of education is that it is an exercise in delayed gratification. That's exactly what it was for us. We were told, "You've got to learn this today, because you're going to need it tomorrow, and, if you do what we tell you today, you'll take that diploma with you, and it will promise you a good life." I'm a typical example. My father's a retired auto worker. He didn't want me in the shop. He wanted me to have a better life than he did, and education was that promise for more. I don't promise kids that today. I cannot promise them that they will make more money, that they will have bigger and better cars; certainly I don't promise them they'll have a bigger house – never promise them that! You see, we have to realize that the basic motivation of education no longer can be a promise for tomorrow.

MOTIVATION – BUT FOR WHAT?

I think college people better get on the stick on this one. It is my belief that if you could do one service for teachers in the classroom, it would be to sit down and help them take a good look at student motivation. We have to realize that we can't tell those kids that a diploma is a guarantee, and that hurts.

First of all, you cannot promise them that a diploma will get them a job tomorrow, because we really don't know what those jobs are going to be. That's how rapidly change is affecting us. During this decade, upwards of 40 percent of all jobs that existed in 1980 will be eliminated by 1990. In ten years 40 percent of our jobs may be there, but they may not be in human hands.

Now, I'm talking particularly about blue collar work. We're going to have jobs, because all kinds of new jobs are coming. The problem is that we really can't prepare for all of them. The irony, of course, in this high-tech age is that what is going to happen is that, of those new jobs that are going to be created, 65 percent of them are going to be for service workers, not high-tech workers. More than half of those service jobs that are going to be created are for unskilled service workers.

There's an interesting report out of Stanford University on the impact of high-tech. Its message, basically, is that we've got to deal with high-tech, but we've got to be careful not to overreact. We do not need to turn out a nation of high-tech experts. As a matter of fact, the report will tell you that the projection in this decade is that the five largest absolute-growth job areas are janitors, number one; nurses' aides and orderlies, two; sales clerks, three; cashiers, four; and waitresses, five. We're moving into a service economy as well as an information economy.

I've shared these perceptions and projections to give you some thoughts about how change, particularly relative to high-tech, has provided us with a task – a task of examining that which we have taken for granted for a very long time. Please don't assume that I'm an iconoclast, that I want you to reject everything that we have ever done. I'm not saying that at all. I'm convinced that we still have to deal with reading, writing, and arithmetic, but I think we have to examine how we go about it.

CHANGING PARTNERS

In doing so, we're going to have to accept that the partnerships involved in education also have to change. When I was going to school and when I started to become involved in education, there were two basic partnerships: between the taxpayer and the school and the family and the school. To explain why I think these partnerships must change, let me share a few final projections about the changing family structure in the United States today.

Let's start with projections about the "typical American family." Do you know what it is? There is no typical American family – there hasn't been since about the early 1970s. As a matter of fact, there's a recent study out of UCLA that identified 65 separate and distinct family types in the United States and projects that we could have as many as 90 by the end of this decade. I doubt if in your most creative moments you could list 90 separate and distinct family types. As a beginning teacher, I used to be able to pretty much assume that a child was coming from a family unit that I could identify, but not today. The whole concept of family is changing in our country.

In fact, futurists are calling it either the "fragmented" or the "flexible" family. Right now in the United States, one out of every four children we teach comes from a single-parent home. By the end of this decade, it's projected that one out of every two children will spend a portion of their time in a single-parent home. Not only that, one out of four of the children we teach will spend a portion of the school years in an aggregate family. I think psychologists are calling that the "blended family." That is where divorced parent one with child marries divorced parent two with child, and you create overnight the Brady Bunch problem. I talked to an educational psychologist the other day who said that psychologists are reporting that there has been no force more difficult for children to deal with than the blended or the aggregate family. It's much more difficult to deal with than the single-parent family, and they're having tremendous problems dealing with that.

Moreover, the family unit will continue to fragment when you consider these statistics. It is projected that if you get married this decade for the first time, there's only a one in four chance that you will stay married to your spouse for a lifetime. Not only that, based upon the statistics of marriage and divorce, you can expect to have three marriages, and sociologists are now even labeling them. Marriage number one, which they're calling your "starter" marriage, will be for love, romance, and sex. When you tire of that – and they say you will – then you will look for someone with whom you'd like to raise children, and

then you will marry a second time to raise children. Based upon the divorce rate in this country, there's every reason to believe when the last child leaves home that you will divorce and remarry — for "mature companionship." That's marriage number three. We can joke about it, but the point is, we no longer can presume to identify what is out there in the family, nor can we presume that the family can or will be an active participant in the educational process.

BUSINESS and INDUSTRY

Furthermore, of all the family units that will be started in the United States during this decade, the United States Government says 48 percent of them will consist of a single person. Now you may not even want to consider that as a family unit, but 48 percent of all new family units this decade will consist of a person living alone by choice — not a reject, but by choice. As a matter of fact, I'm sure you've all seen the statistics that indicate that by the end of this decade, only about 50 percent of the families or households in the United States will have a child in our public school system, K-12.

So you see that the partnerships are probably changing — are going to have to change — and we're going to have to explore new kinds of partnerships to augment what has disappeared. I (along with 10 million other people, if reports are accurate) believe many of the new partnerships will be with business and industry. These will not be the kinds of partnerships we've had in the past. Those "partnerships" basically came down to: "we've got some leftover equipment or equipment that's ten years old, so we'll give it to you." That's not a partnership.

I know there are concerns about business-education partnerships. But consider this: Where did the impetus come from for all of the recent national reports on education? Most of those reports came about because business and industry were complaining. Maybe it is time to act on that old proverb, "put your money where your mouth is," and explore some new kinds of relationships.

"OUR NATION IS NOT AT RISK"

We are facing an era of high technology that will lead to the disappearance of mental labor the same way that physical labor has disappeared. It doesn't mean that we will not think. It means that the labor of thinking will end. Therefore, what I would suggest to you is that we're going to have to think about why students should learn, what they should learn, when they should learn it, and just how much technology will be involved. The irony of education today is that our kids are already there. I'm convinced that a lot of our kids are already into the information age, and we've got to catch up with them.

I don't think any of us should panic over those national reports on education; by the way, they're doing us a service, on one hand, by giving us some national attention and giving us a forum to be heard. It is our task, on the other hand, to respond. If there was only one report, we could just let it ride, but there are too many of them out there right now. There is some housecleaning in order; business as usual no longer can be. But I'll leave you with this final message.

Our nation is not at risk. It's certainly not at risk because of us in education. If you read the report of the National Commission on Excellence in Education, it would lead you to believe education is to blame for everything from inflation to the weather. We are not. We are a nation at change.

APPENDICES

APPENDIX A

RESOURCE PERSONS FOR SCHOOLING AND TECHNOLOGY

Participants and Presenters for "Creative Partnerships in Technology – An Open Forum"

Ms. Gail Albritton, Speaker's Office, Florida House of Representatives

Ms. Barbara Andreport, Director, MIS, Louisiana Department of Education

Mr. Larry Armstrong, Office of Instructional TV and Radio, South Carolina Department of Education

Dr. Eloise T. Barron, Secondary Education Program (9-12), Georgia Department of Education

Ms. Joey Baughmann, Office of Instructional Services, Georgia Department of Education

Mr. Neal Berger, House Education Committee, Florida House of Representatives

Dr. Barry L. Berman, Area Marketing Manager, Monroe Systems for Business, Atlanta, GA

Mr. Fred Beyer, Supervisor, Math & Science/Advanced Placement, Cumberland County Schools (NC)

Ms. Margaret Bingham, Computer Coordinator, Division of Media & Technology, North Carolina Department of Public Instruction

Ms. C. Pristen Bird, Instructional Computing Consultant, Educational Technology, Florida Department of Education

Dr. Ronald E. Bird, Research Director, Southeastern Regional Council for Educational Improvement

Mr. Robert D. Boyd, Assistant Superintendent for Personnel Services, North Carolina Department of Public Instruction

Dr. R. Scott Bradshaw, Division of Curriculum Services, Georgia Department of Education

Ms. Judy Brasington, Office of Instructional TV and Radio, South Carolina Department of Education

Mr. David Brittain, Administrator, Education Technology, Florida Department of Education

Dr. Bill Brown, Special Assistant for Research, North Carolina Department of Public Instruction

Ms. Elsie Brumback, Assistant Superintendent for Media & Technology, North Carolina Department of Public Instruction

Dr. Patricia K. Burns, Administrative Assistant for Long-Range Planning, Greenville City Schools (SC)

Mr. Harold L. Cole, Director, Educational Data Center, South Carolina Department of Education

Ms. Ellouise Collins, Division of Special Programs, Georgia Department of Education

Ms. Leila G. Cooper, Audio Visual Library, South Carolina Department of Education

Dr. Milly Cowles, Dean, School of Education, University of Alabama in Brimingham

Ms. Jean Dampier, Computer Science Teacher, University Lab School, Louisiana State University

Mr. Rodney H. Davis, Administrator, Teacher Certification, Florida Department of Education

Dr. Donald E. Dearborn, Assistant Superintendent – Elementary Education, Alexandria City Schools (VA)

Mr. Ron Denning, Cumberland County Schools (NC)

Mr. Maurice A. Dunn, Superintendent, Hot Springs Public Schools (AR)

Ms. Audrey B. Eddy, Office of Instructional TV and Radio, South Carolina Department of Education

Dr. Chad Ellett, Office of the Dean, College of Education, Louisiana State University

Mr. Robert Elton, Office of Instructional TV and Radio, South Carolina Department of Education

Dr. Alfonso J. Evans, Educational Supervisor, Office of Planning, South Carolina Department of Education

Dr. B.E. Fancher, Dean, College of Education, University of Montevallo (AL)

Mr. John Fortenberry, Consultant, Instructional Computing, Arkansas Department of Education

Dr. Carol Furtwengler, Director, Research Development Systems, Tennessee Department of Education

Dr. Willis Furtwengler, Director, Office of Educational Services, George Peabody College for Teachers, Vanderbilt University (TN)

Mr. John C. Gaines, Director, Secondary Education, Tennessee Department of Education

Mr. Clyde H. Green, Director, Office of Instructional TV and Radio, South Carolina Department of Education

Mr. John J. Guilbeaux, Director of Federal Projects for Special School District No. 1 (LA)

Dr. Carlos E. Gutierrez, Superintendent, Albemarle County Schools (VA)

Dr. John A. Harper, Member, Louisiana Board of Elementary and Secondary Education

Mr. Joshua Hartford, Southeastern Regional Council for Educational Improvement

Dr. John Hawes, Public Information, Louisiana Department of Education

Dr. LeRoy Hay, 1983 National Teacher of the Year, Manchester, CT

Dr. Virginia Hayes, Assistant Dean, School of Education, Auburn University (AL)

Mr. Robert R. Hill, Deputy Superintendent for Administration and Planning, South Carolina Department of Education

Dr. Nicholas Hobar, Assistant Bureau Chief, Division of Special Educational Development, West Virginia Department of Education

Dr. Morris Holmes, Associate Director for Management and Development, Arkansas Department of Education

Mrs. Betty J. Howie, Southeastern Regional Council for Educational Improvement

Dr. Dustin Heuston, Chairman, World Institute for Computer-Assisted Teaching Systems, Orem, UT

Mr. William B. Hynds, Mathematics Consultant, Office of General Education, Curriculum Development Section, South Carolina Department of Education

Mr. H.F. Johnson, Jr., Associate State Superintendent of Schools, Georgia Department of Education

Mr. William P. Johnson, Associate State Superintendent of Schools, Georgia Department of Education

Mr. T.E. Johnston, Berkeley County Schools (SC)

Dr. Lucille G. Jordan, Associate State Superintendent of Schools, Georgia Department of Education

Ms. Andrea Kelly, Supervisor, Business & Office Education, South Carolina Department of Education

Dr. Eloise T. Kirk, ECIA Coordinator, Chapter II Section, Administrative & Financial Services, Alabama Department of Education

Dr. Elmer Knight, Director, Office of Teacher Education & Certification, South Carolina Department of Education

Dr. Carolyn Lavely, Assistant to the House Speaker, Speaker's Office, Florida House of Representatives

Dr. Charles J. Law, Jr., Executive Director, Southeastern Regional Council for Educational Improvement

Mrs. Sylvia Lawless, Director of Instruction, Tarrant City Board of Education (AL)

Mrs. Carolyn Lee, President, Georgia Association of Educators

Dr. Jane F. Lee, State Schools Section, Georgia Department of Education

Ms. Jane Leone, Assistant Superintendent for Instruction, Broward County Schools (FL)

Dr. Harvey Long, Education Applications Constultant, IBM, Bocan Raton, FL

Dr. Kenneth Magill, Director, Division of Instructional Media and Technology, Virginia Department of Education

Dr. George Malo, Director, Research and Development, Tennessee Department of Education

Dr. Frank Markus, Department of Educational Administration, Memphis State University (TN)

Mr. Nicholas Martin, Office of Instructional TV and Radio, South Carolina Department of Education

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Ms. Shirley McCandless, Administrative Officer, Management Information Systems, Louisiana Department of Education

Hon. Charles McDaniel, Superintendent of Schools, Georgia Department of Education

Dr. Cecil McDermott, Special Project Administrator, Arkansas Department of Education

Ms. Amy McMurtrey, Consultant, Teacher Education and Staff Development, Georgia Department of Education

Dr. Ronald A. McWhirt, County Superintendent, Charleston County School District (SC)

Dr. Jayne Meyer, Coordinator, Teacher Education, Alabama Department of Education

Mr. Don Morton, Administrative Assistant to the Superintendent, Etowah County Board of Education, Gasden, AL.

Mr. Lew Nall, Education Consultant, Division of Public Schools, Florida Department of Education

Mr. Frank Norris, Director of Materials, Instruction, and Textbooks, Louisiana Department of Education

Ms. Dorothy Owen, Office of Instructional TV and Radio, South Carolina Department of Education

Dr. Stephen M. Preston, Director, Division of Planning, Research, and Evaluation, Georgia Department of Education

Mr. Robert Reese, Office of Instructional Radio and TV, South Carolina Department of Education

Dr. Werner Rogers, Associate Superintendent, Planning & Development, Georgia Department of Education

Dr. Shirl Schiffman, Assistant Professor, Department of Curriculum and Instruction, University of Virginia

Dr. Tom Sills, College of Education, Francis Marion College (SC)

Ms. Evelyn Sisco, Classroom Teacher, Peabody Magnet School, Alexandria, LA

Ms. Sharon Sprowls, Assistant to California Assemblyman Richard Katz, Sacramento, CA

Ms. Carol Swinney, Macon Area Vocational–Technical School (GA)

Dr. Lejeane G. Thomas, Department of Education, Louisiana Department of Education

Ms. Maria Vecchio, Coordinator of Personnel Relations, Southeast Regional Education Center, Jacksonville, NC

Dr. Charles Watson, Administrator, Instructional Computing, Arkansas Department of Education

Ms. Margaret Whelan, Administrator, Gifted & Talented Program, Caddo Parish School System, Shreveport, LA

Mrs. Jean P. Williams, Curriculum Services, Florida Department of Education

Mrs. Mildred Williams, Southeastern Regional Council for Educational Improvement

Dr. Peyton Williams, Jr., Associate State Superintendent of Schools, Georgia Department of Education

Dr. Bernice H. Willis, Deputy Director, Southeastern Regional Council for Educational Improvement

Mr. Ronald Wright, Director, Learning Resource Center, Alabama Department of Education

Ms. Mary J. Wynn, Professional Development Center, Caddo Parish School Board, Shreveport, LA

APPENDIX B

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APPENDIX C

PRODUCERS OF PROFESSIONAL EVALUATION SERVICES

A listing compiled by staff of the Division of Media and Technology Services, North Carolina Department of Public Instruction, Raleigh, NC

MicroSIFT *(300 S.W. 6th Ave., Portland, OR 97204)*

Part of the Northwest Regional Educational Laboratory, serves as a clearinghouse for software evaluations prepared by a network of practicing educators. Evaluation form developed. *Evaluator's Guide for Microcomputer-Based Instructional Packages* available through ICCE (Department of Computer & Information Science, University of Oregon, Eugene, OR 97403).

EPIE Institute *(P.O. Box 620, Stony Brook, NY 11790)*

Publishes software reviews prepared by teachers specially trained by EPIE. The reviews are available at a yearly subscription rate. Evaluation form developed.

California Library Media Consortium for Classroom Evaluation of Microcomputer Courseware *(San Mateo County Office of Education, Redwood City, CA 94063)*

Has published two issues of a courseware review document. Evaluation form developed.

The National Council of Teachers of Mathematics *(1906 Association Drive, Reston, VA 22091)*

Published a booklet in 1981 entitled *Guidelines for Evaluating Computerized Instructional Materials.* Evaluation form developed.

Courseware Report Card *(150 W. Carob St., Compton, CA 90220)*

Is a publication containing reviews written by practicing or former teachers. The reviews are available in two editions – K-6 and 7-12 – five times per year, for a subscription fee. Evaluation form developed.

School Microware Reviews *(P.O. Box 246, Dresden, ME 04342)*

Contains teachers' reviews and manufacturers' comments. Three issues are available for a subscription fee.

Various journals and periodicals that provide reviews and/or sample evaluation forms:

The Computing Teacher, Classroom Computer News, The Apple Journal of Courseware Review, Pipeline (Conduit), AEDS Monitor, Creative Computing, Educational Computer, Educational Technology, Electronic Learning, Infoworld.

Several educational organizations/groups have developed software evaluation procedures and forms:

Minnesota Educational Computing Consortium (MECC), North Carolina Department of Public Instruction, Illinois University (Urbana) Department of Secondary Education, Teachers College – Columbia University, Utah State University – SECTOR Project.

APPENDIX D

OVERVIEW OF AB 803
CALIFORNIA COMPUTER EDUCATION ACT OF 1983

Prepared by staff to Richard Katz, Assemblyman, 39th District

Department of Education Reorganization

- Consolidates existing committees into a single Educational Technology Committee, which will oversee the Educational Technology Local Assistance Program.
- Provides for the Superintendent of Public Instruction to coordinate all department activities relating to computer education through a unit within the Department of Education.

School District Computer Education Planning

- Provides for a process by which districts may receive funding and technical assistance with computer education planning. Emphasis will be on teacher training and equitable student access to computer resources.
- Allows districts and county offices of education developing computer education, math, reading, and science plans to be eligible for Technology Local Assistance Program funds.
- Authorizes County Offices of Education to identify and assist districts without plans.

Teacher Training in Computer Education

- Requires districts doing district-wide computer education plans to assess their teacher training needs and make provisions for meeting those needs in their plans.
- Encourages continued training of teachers in computer skills by the Teacher Education and Computer Centers and cooperation with credential programs in developing computer courses for future teachers.

University Teacher Education Programs

- Allows California colleges and universities to be eligible for Technology Local Assistance Program funds to provide computer education as a part of their teacher preparation programs.
- Allows institutes of higher education offering computer education courses as part of their teacher preparation programs to be eligible for research grants for the study of computer-assisted instruction and high technology social impacts.

Access to Categorical Equipment

- Requires districts doing district-wide plans to include an assessment of the use of categorical program computer hardware and software, and to explore the possibilities for making those computers available to all students when not in use by the students in the categorical programs.

Regional Occupational Programs and Centers

- Allows ROC/Ps to receive local assistance funds for conducting job market surveys of computer-related occupations.

General Public Computer Education

- Provides for the Educational Technology Committee to award a contract to produce a television-based learning system that will inform teachers, parents, and the general public of the nature, operation, and function of microcomputers and their educational applications in the K-12 school system.

Coordination with Industry

- Involves industry through representation on the Educational Technology Committee.
- Directs the Superintendent to work with industry and individual businesses to inform them of school districts' needs for computer equipment, software, training, and technical help.
- Empowers the Superintendent to negotiate volume purchases of computers and computerized instructional materials.
- Directs the Superintendent to identify for developers schools' software needs, and to contract for specified high-priority educational software. Funds would also be available to students and teachers for educational software research and development.

Computer Education Funding

- Utilizes the budget process for future funding of the educational technology program.
- Uses funding contained in the education finance reform package, SB 813, for the first six months of the program.

APPENDIX E

TEACHER COMPETENCIES

This list of competencies for teachers in computer education, compiled by J. Richard Dennis, was included in "Practicum Activities for Training Teachers to Use Computers," published by the University of Illinois, College of Education, 1979. (It was presented to the conference by staff of the Florida State Department of Education.)

1. Familiarity with computerized teaching materials (i.e., instructional programs in a variety of fields).
2. Ability to integrate computerized teaching materials into a course.
3. General knowledge of the functioning of CMI (Computer Managed Instruction) systems.
4. Understanding of effective design of drill and practice in a variety of teaching situations.
5. Ability to apply computerized drill and practice in a variety of teaching situations.
6. Familiarity with computer simulations and models.
7. Experience in preliminary design and construction of a simulation.
8. Knowledge of the uses of simulations as teaching tools.
9. Ability to evaluate the effectiveness of a course that uses computerized teaching materials.
10. Ability to determine the computer needs of a school.
11. Ability to draft specifications (requests for proposals) which set down the needs and desires of the school and invite proposals or bids from potential suppliers.
12. Ability to be highly critical of suppliers' proposals and their machines.
13. Ability to assemble data about proposed equipment to facilitate decision-making (costs, performance data, hardware characteristics, software support, etc.).
14. Familiarity with instructional games.
15. Knowledge of how to use instructional games appropriately and effectively in teaching.
16. Physical familiarity with computer equipment (i.e., everyday operation and use of a range of different machines).
17. Knowledge of troubleshooting procedures and means of access to professional help (i.e., knowing how to determine if a piece of equipment is ailing; if it is, knowing whom to call to fix it).
18. Knowledge of sources for computer materials.
19. Knowledge of how to improve less than adequate instructional computer programs.
20. Ability to instruct others in the social role and impact of computers in society.
21. Ability to evaluate the effectiveness of instructional computer programs.
22. Knowledge of alternative uses of computers in school (i.e., as class recordkeepers, term paper editors, etc.).
23. Awareness of the value of involving students in the development of computerized instructional materials.
24. Knowledge of processes of involving students in the development of computerized instructional materials.
25. Knowledge of computer programming (Dennis, 1979, p. 6).